Shenzhen Huatongwei International Inspection Co., Ltd.
1/F,Bldg 3,Hongfa Hi-tech Industrial Park,Genyu Road,Tianliao,Gongming,Shenzhen,China
Phone:86-755-26748019 Fax:86-755-26748089 http://www.szhtw.com.cn

# TEST REPORT

| | |
|---|---|
| **Report Reference No. ..... :** | **TRE1605015201** **R/C……..: 31880** |
| **FCC ID ..... :** | **2AE6CER9000U1** |
| **Applicant's name ..... :** | **Shenzhen Excera Technology Co., Ltd.** |
| Address..... : | 3rd Floor, Jiada R&D Building, No.5 Songpingshan Road , Hi-Tech Park North, Nanshan District , Shenzhen, China |
| **Manufacturer.....:** | **Shenzhen Excera Technology Co., Ltd.** |
| Address.....: | 3rd Floor, Jiada R&D Building, No.5 Songpingshan Road , Hi-Tech Park North, Nanshan District , Shenzhen, China |
| **Test item description ..... :** | **Digital Repeater** |
| Trade Mark .....: | EXCERA |
| Model/Type reference..... : | ER9000 U1 |
| Listed Model(s) .....: | - |
| **Standard ..... :** | **FCC Part 90/FCC Part 80/ FCC Part 74/ FCC Part 22** |
| Date of receipt of test sample……..: | May 26, 2016 |
| Date of testing……: | May 27, 2016 – June 24, 2016 |
| Date of issue……...: | June 24, 2016 |
| **Result..... ……..:** | **PASS** |

| | | |
|---|---|---|
| Compiled by ( position+printed name+signature)..: | File administrators Shayne Zhu | Shayne Zhu |
| Supervised by ( position+printed name+signature)..: | Project Engineer Cary Luo | Cary Luo |
| Approved by ( position+printed name+signature)..: | RF Manager Hans Hu | Hans Hu |

| | |
|---|---|
| **Testing Laboratory Name ..... :** | **Shenzhen Huatongwei International Inspection Co., Ltd.** |
| Address..... : | 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China |

# Contents

# 1. TEST STANDARDS AND TEST DESCRIPTION

## 1.1. Test Standards

The tests were performed according to following standards:
FCC Rules Part 90: 2016 Private land mobile radio services.
FCC Rules Part 80：2016 STATIONS IN THE MARITIME SERVICES
FCC Rules Part 74：2016 EXPERIMENTAL RADIO, AUXILIARY, SPECIAL BROADCAST AND OTHER PROGRAM DISTRIBUTIONAL SERVICES
FCC Rules Part 22：2016 PUBLIC MOBILE SERVICES
TIA/EIA 603 D: June 2010 Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.
FCC Part 15 Subpart B: 2016 Unintentional Radiators
FCC Part 2: 2014 Frequency allocations and radio treaty matters, general rules and regulations.
KDB579009 D01 v03r01: Questions and Answers on Re-farming Part 90 frequencies
KDB 579009 D02 v01r02: Transition Summary Table

## 1.2. Test Description

| **Transmitter Requirement** | | | |
|---|---|---|---|
| Test item | Standards requirement | Result | |
| | | Pass | N/A |
| Maximum Transmitter Power | FCC Part 90.205，FCC Part 80.215，FCC Part 74.461，FCC Part 22.727，FCC Part 2.1046 | ☒ | |
| Modulation Characteristic | FCC Part 90.207，FCC Part 80.213，FCC Part 74.463，FCC Part 2.1047 | ☒ | |
| Occupied Bandwidth | FCC Part 90.209，FCC Part 90.210，FCC Part 80.207，FCC Part 74.462，FCC Part 22.731，FCC Part 22.357，FCC Part 2.1049 | ☒ | |
| Emission Mask | FCC Part 90.209，FCC Part 90.210，FCC Part 80.207，FCC Part 74.462，FCC Part 22.731，FCC Part 22.357，FCC Part 2.1049 | ☒ | |
| Frequency Stability | FCC Part 90.213，FCC Part 80.209，FCC Part 74.464，FCC Part 22.355，FCC Part 2.1055 | ☒ | |
| Transmitter Frequency Behavior | FCC Part 90.214 | ☒ | |
| Transmitter Radiated Spurious Emission | FCC Part 90.210，FCC Part 80.211，FCC Part 74.461，FCC Part 22.861，FCC Part 2.1053 | ☒ | |
| Spurious Emission On Antenna Port | FCC Part 90.210，FCC Part 80.211，FCC Part 74.461，FCC Part 22.861，FCC Part 2.1051 | ☒ | |
| **Receiver Requirement** | | | |
| Test item | Standards requirement | Result | |
| | | Pass | N/A |
| Conducted Emission | FCC Part 15.207 | | ☒ |
| Radiated Spurious Emission | FCC Part 15.109 | | ☒ |

# 2. SUMMARY

## 2.1. Client Information

| | |
|---|---|
| Applicant: | Shenzhen Excera Technology Co., Ltd. |
| Address: | 3rd Fl oor, Jiada R&D Bu ilding, No.5 Songpingshan Ro ad , Hi -Tech P ark North, Nanshan District , Shenzhen |
| Manufacturer: | Shenzhen Excera Technology Co., Ltd. |
| Address: | 3rd Fl oor, Jiada R&D Bu ilding, No.5 Songpingshan Ro ad , Hi -Tech P ark North, Nanshan District , Shenzhen |

## 2.2. Product Description

| | | |
|---|---|---|
| Name of EUT: | Digital Repeater | |
| Trade mark: | EXCERA | |
| Model/Type reference: | ER9000 U1 | |
| Listed mode(s): | - | |
| Power supply: | DC 13.6V, AC 120V/60Hz | |
| Battery information: | - | |
| Charger information: | - | |
| Adapter information: | - | |
| | | |
| Operation Frequency Range: | From 400MHz to 470 MHz | |
| Rated Output Power: | High Power: 47 W (46.72dBm)/Low Power: 5W (36.98dBm) | |
| Modulation Type: | Analog Voice: | FM |
| | Digital Voice /Digital Data: | 4FSK |
| Digital Type: | DMR | |
| Channel Separation: | Analog Voice: | ☒ 12.5kHz |
| | Digital Voice /Digital Data: | ☒ 12.5kHz ☐ 6.25kHz |
| Emission Designator: | Analog Voice: | ☒12.5kHz Channel Separation: 6K12F3E<br>☐25kHz Channel Separation: --- |
| | Digital Voice& Data: | ☒12.5kHz Channel Separation: 7K50FXW<br>☐6.25kHz Channel Separation: --- |
| | Digital Data: | ☒12.5kHz Channel Separation: 7K50FXD<br>☐6.25kHz Channel Separation: --- |
| Support data rate: | 9.6kbps | |
| Antenna Type: | External | |
| Maximum Transmitter Power: | Digital | 48.87W for 12.5kHz Channel Separation |
| | Analog | 48.42W for 12.5kHz Channel Separation |

Note:

1)The product has the same digital working characters when operating in both two digitized voice/data mode. So only one set of test results for digital modulation modes are provided in this test report.

2)This equipment is capable of supporting a minimum data rate of 4800 bits per second per 6.25 kHz of channel bandwidth. DMR interphone's bandwidth is 12.5 kHz, and it has a double time slot, one is the speech time slot, one is the data time slot, just language sequence is satisfied with 4800 bps/6.25 kHz BW.

## 2.3. Test frequency list

| Mode | Modulation | Operation Frequency Range | Test Frequency (MHz) |
|---|---|---|---|
| Analog FM | | 400MHz~420MHz | $CH_L$ 406.11 25 |
| | | | $CH_M$ 413.05 00 |
| | | | $CH_H$ 419.98 75 |
| | | 420MHz~470MHz | $CH_L$ 421.01 25 |
| | | | $CH_M$ 445.00 00 |
| | | | $CH_H$ 469.98 75 |
| Digital 4FSK | | 400MHz~420MHz | $CH_L$ 406.11 25 |
| | | | $CH_M$ 413.05 00 |
| | | | $CH_H$ 419.98 75 |
| | | 420MHz~470MHz | $CH_L$ 421.01 25 |
| | | | $CH_M$ 445.00 00 |
| | | | $CH_H$ 469.98 75 |

*Note:*

*In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the above listed frequency for testing.*

## 2.4. EUT operation mode

| Test mode | Transmitting | Receiving | Power level | | Digital | Analog |
|---|---|---|---|---|---|---|
| | | | High | Low | 12.5kHz | 12.5kHz |
| TX1 | √ | | √ | | √ | |
| TX2 | √ | | | √ | √ | |
| TX3 | √ | | √ | | | √ |
| TX4 | √ | | | √ | | √ |

*√: is operation mode.*

## 2.5. EUT configuration

**The following peripheral devices and interface cables were connected during the measurement:**

● - supplied by the manufacturer

○ - supplied by the lab

| | | | |
|---|---|---|---|
| ● | Power Cable | Length (m) : | 3m |
| | | Shield : | Unshielded |
| | | Detachable : | Undetachable |
| ○ | Multimeter Manufa | cturer : | / |
| | | Model No. : | / |

# 3. TEST ENVIRONMENT

## 3.1. Address of the test laboratory

Laboratory:Shenzhen Huatongwei International Inspection Co., Ltd.
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China
Phone: 86-755-26748019 Fax: 86-755-26748089

## 3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

**CNAS-Lab Code: L1225**
Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories, Date of Registration: February 28, 2015. Valid time is until February 27, 2018.

**A2LA-Lab Cert. No. 3902.01**
Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing. Valid time is until December 31, 2016.

**FCC-Registration No.: 317478**
Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 317478, Renewal date Jul. 18, 2014, valid time is until Jul. 18, 2017.

**IC-Registration No.: 5377A&5377B**
The 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377A on Dec. 31, 2013, valid time is until Dec. 31, 2016.
Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377B on Dec.03, 2014, valid time is until Dec.03, 2017.

**ACA**
Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

**VCCI**
The 3m Semi-anechoic chamber (12.2m×7.95m×6.7m) of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2484. Date of Registration: Dec. 20, 2012. Valid time is until Dec. 29, 2015.
Radiated disturbance above 1GHz measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-292. Date of Registration: Dec. 24, 2013. Valid time is until Dec. 23, 2016.
Main Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: C-2726. Date of Registration: Dec. 20, 2012. Valid time is until Dec. 19, 2015.
Telecommunication Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: T-1837. Date of Registration: May 07, 2013. Valid time is until May 06, 2016.

**DNV**
Shenzhen Huatongwei International Inspection Co., Ltd. has been found to comply with the requirements of DNV towards subcontractor of EMC and safety testing services in conjunction with the EMC and Low voltage Directives and in the voluntary field. The acceptance is based on a formal quality Audit and follow-ups according to relevant parts of ISO/IEC Guide 17025 (2005), in accordance with the requirements of the DNV Laboratory Quality Manual towards subcontractors. Valid time is until Aug. 24, 2016.

## 3.3. Environmental conditions

| Normal Conditon | |
|---|---|
| Relative humidity: | 20 % to 75 %. |
| Air Pressure: | 950~1050mba |
| Voltage: | AC 120V/60Hz,DC 13.6V |

## 3.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen Huatongwei laboratory is reported:

| Test Items | Measurement Uncertainty | Notes |
|---|---|---|
| Frequency stability | 25 Hz | (1) |
| Transmitter power conducted | 0.57 dB | (1) |
| Transmitter power Radiated | 2.20 dB | (1) |
| Conducted spurious emission 9KHz-40 GHz | 1.60 dB | (1) |
| Conducted Emission 9KHz-30MHz | 3.39 dB | (1) |
| Radiated Emission 30~1000MHz | 4.65 dB | (1) |
| Radiated Emission 1~18GHz | 5.16 dB | (1) |
| Radiated Emission 18-40GHz | 5.54 dB | (1) |
| Occupied Bandwidth | --------- | (1) |
| Emission Mask | --------- | (1) |
| Modulation Characteristic | --------- | (1) |
| Transmitter Frequency Behavior | --------- | (1) |

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

## 3.5. Equipments Used during the Test

| Conducted Emission | | | | |
|---|---|---|---|---|
| Name of Equipment | Manufacturer | Model | Serial Number | Last Cal. |
| Artificial Mains | Rohde&Schwarz | ESH2-Z5 | 100028 | 2015/11/2 |
| EMI Test Receiver | Rohde&Schwarz | ESCS 30 | 100038 | 2015/11/2 |
| Pulse Limiter | Rohde&Schwarz | ESHSZ2 | 100044 | 2015/11/2 |
| EMI Test Software | Rohde&Schwarz | ES-K1 V1.71 | N/A | N/A |
| RF COMMUNICATION TEST SET | HP 8920A | | 3813A10206 | 2015/11/2 |
| Artificial Mains | Rohde&Schwarz | ESH3-Z6 | 100210 | 2015/11/2 |
| Artificial Mains | Rohde&Schwarz | ESH3-Z6 | 100211 | 2015/11/2 |

| Modulation Characteristic | | | | |
|---|---|---|---|---|
| Name of Equipment | Manufacturer | Model | Serial Number | Last Cal. |
| RF COMMUNICATION TEST SET | HP 8920A | | 3813A10206 | 2015/11/2 |

| Frequency Stability | | | | |
|---|---|---|---|---|
| Name of Equipment | Manufacturer | Model | Serial Number | Last Cal. |
| RF COMMUNICATION TEST SET | HP 8920A | | 3813A10206 | 2015/11/2 |
| Signal Generator | Rohde&Schwarz | SMT03 | 100059 | 2015/11/2 |
| Climate Chamber | ESPEC | EL-10KA 05107008 | | 2015/11/2 |

| Transmitter Radiated Spurious Emission | | | | |
|---|---|---|---|---|
| Name of Equipment | Manufacturer | Model | Serial Number | Last Cal. |
| Ultra-Broadband Antenna | Rohde&Schwarz | HL562 | 100015 | 2015/11/2 |
| EMI Test Receiver | Rohde&Schwarz | ESI 26 | 100009 | 2015/11/2 |
| RF Test Panel | Rohde&Schwarz | TS / RSP | 335015/ 0017 | N/A |
| HORN ANTENNA | Rohde&Schwarz | HF906 | 100039 | 2015/12/2 |
| Turntable ETS | | 2088 | 2149 | N/A |
| Antenna Mast | ETS | 2075 | 2346 | N/A |
| EMI Test Software | Rohde&Schwarz | ES-K1 V1.71 | N/A | N/A |
| RF COMMUNICATION TEST SET | HP 8920A | | 3813A10206 | 2015/11/2 |
| Ultra-Broadband Antenna | ShwarzBeck | VULB9163 | 538 | 2015/11/2 |
| Ultra-Broadband Antenna | ShwarzBeck | VULB9163 | 539 | 2015/11/2 |
| HORN ANTENNA | ShwarzBeck | 9120D | 1012 | 2015/11/2 |
| HORN ANTENNA | ShwarzBeck | 9120D | 1011 | 2015/11/2 |
| TURNTABLE MATURO | | TT2.0 | ---- | N/A |
| ANTENNA MAST | MATURO | TAM-4.0-P | ---- | N/A |

| Maximum Transmitter Power & Spurious Emission On Antenna Port & Occupied Bandwidth & Emission Mask | | | | |
|---|---|---|---|---|
| Name of Equipment | Manufacturer | Model | Serial Number | Last Cal. |
| Receiver Roh | de&Schwarz | ESI 26 | 100009 | 2015/11/2 |
| Attenuator R&S | | ESH3-22 | 100449 | 2015/11/2 |
| RF COMMUNICATION TEST SET | HP 8920A | | 3813A10206 | 2015/11/2 |
| Digital Radio Test Set | AEROFLEX | 3920 | 299001967 | 2015/11/2 |
| High-Pass Filter | Anritsu | MP526B | 6220875256 | 2015/11/2 |
| High-Pass Filter | Anritsu | MP526D | 6220878392 | 2015/11/2 |
| Spectrum Analzyer | Aglient | E4407B | MY44210775 | 2015/11/2 |
| Spectrum Analzyer | Rohde&Schwarz | FSP40 1164.4 | 391.40 | 2015/11/2 |
| SPECTRUM ANALYZER | Agilent E4407B | | MY44210775 | 2015/11/2 |

| Transient Frequency Behavior | | | | |
|---|---|---|---|---|
| Name of Equipment | Manufacturer | Model | Serial Number | Last Cal. |
| Signal Generator | Rohde&Schwarz | SMT03 | 100059 | 2015/11/2 |
| Storage Oscilloscope | Tektronix | TDS3054B | B033027 | 2015/11/2 |
| RF COMMUNICATION TEST SET | HP 8920A | | 3813A10206 | 2015/11/2 |

The calibration interval was one year.

# 4. TEST CONDITIONS AND RESULTS

## 4.1. Maximum Transmitter Power

Applicants for licenses must request and use no more power than the actual power necessary for satisfactory operation.

**LIMIT**

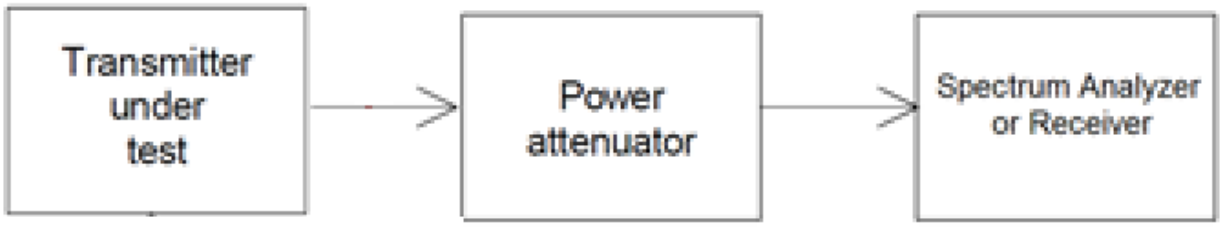
**FCC Part 90.205，FCC Part 80.215，FCC Part 74.461，FCC Part 22.727，FCC Part 2.1046**

Maximum ERP is dependent upon the station's antenna HAAT and required service area. The output power shall be within ±1 dB of the manufacturer's rated power listed in the equipment specifications.

**TEST PROCEDURE**

Measurements shall be made to establish the radio frequency power delivered by the transmitter the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted bellow:
If the power output is adjustable, measurements shall be made for the highest and lowest power levels.
Connect the equipment as illustrated.

**TEST CONFIGURATION**




**TEST MODE:**

Please reference to the section 2.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

*Please refer to the below test data:*

*AC 120V:*

| Operation Mode | Test Frequency (MHz) | Measured power (dBm) | Difference ( dB ) | Limit (dB) | Result |
|---|---|---|---|---|---|
| TX1 | 406.1125 | 46.45 | -0.27 | -1 ~ +1 | Pass |
| | 413.05 | 46.56 | -0.16 | | |
| | 419.9875 | 46.67 | -0.05 | | |
| | 421.0125 46.89 | | 0.17 | | |
| | 445 | 46.64 | -0.08 | | |
| | 469.9875 | 46.55 | -0.17 | | |
| TX2 | 406.1125 | 36.72 | -0.27 | -1 ~ +1 | Pass |
| | 413.05 | 36.57 | -0.42 | | |
| | 419.9875 | 36.85 | -0.14 | | |
| | 421.0125 | 36.92 | -0.07 | | |
| | 445 | 36.73 | -0.26 | | |
| | 469.9875 | 36.62 | -0.37 | | |
| TX3 | 406.1125 | 46.37 | -0.35 | -1 ~ +1 | Pass |
| | 413.05 46.85 | | 0.13 | | |
| | 419.9875 | 46.54 | -0.18 | | |
| | 421.0125 | 46.39 | -0.33 | | |
| | 445 | 46.21 | -0.51 | | |
| | 469.9875 | 46.55 | -0.17 | | |
| TX4 | 406.1125 | 36.27 | -0.72 | -1 ~ +1 | Pass |
| | 413.05 | 36.44 | -0.55 | | |
| | 419.9875 | 36.37 | -0.62 | | |
| | 421.0125 | 36.55 | -0.44 | | |
| | 445 | 36.24 | -0.75 | | |
| | 469.9875 | 36.85 | -0.14 | | |

Maximum ERP:

| Operation Mode | Test Frequency (MHz) | Measured power (dBm) | Tolerance (dB) | Output Power (dBm) | Antenna Gain (dBd) | ERP (dBm) | ERP (W) | Max ERP (W) |
|---|---|---|---|---|---|---|---|---|
| TX1 | 406.1125 | 46.45 | 1.00 | 47.45 | 4.35 | 51.80 | 151.36 | 167.49 |
| | 413.05 | 46.56 | 1.00 | 47.56 | 4.35 | 51.91 | 155.24 | |
| | 419.9875 | 46.67 | 1.00 | 47.67 | 4.35 | 52.02 | 159.22 | |
| | 421.0125 | 46.89 | 1.00 | 47.89 | 4.35 | 52.24 | 167.49 | |
| | 445 | 46.64 | 1.00 | 47.64 | 4.35 | 51.99 | 158.12 | |
| | 469.9875 | 46.55 | 1.00 | 47.55 | 4.35 | 51.90 | 154.88 | |
| TX2 | 406.1125 | 36.72 | 1.00 | 37.72 | 4.35 | 42.07 | 16.11 | 16.87 |
| | 413.05 | 36.57 | 1.00 | 37.57 | 4.35 | 41.92 | 15.56 | |
| | 419.9875 | 36.85 | 1.00 | 37.85 | 4.35 | 42.20 | 16.60 | |
| | 421.0125 | 36.92 | 1.00 | 37.92 | 4.35 | 42.27 | 16.87 | |
| | 445 | 36.73 | 1.00 | 37.73 | 4.35 | 42.08 | 16.14 | |
| | 469.9875 | 36.62 | 1.00 | 37.62 | 4.35 | 41.97 | 15.74 | |
| TX3 | 406.1125 | 46.37 | 1.00 | 47.37 | 4.35 | 51.72 | 148.59 | 165.96 |
| | 413.05 | 46.85 | 1.00 | 47.85 | 4.35 | 52.20 | 165.96 | |
| | 419.9875 | 46.54 | 1.00 | 47.54 | 4.35 | 51.89 | 154.53 | |
| | 421.0125 | 46.39 | 1.00 | 47.39 | 4.35 | 51.74 | 149.28 | |
| | 445 | 46.21 | 1.00 | 47.21 | 4.35 | 51.56 | 143.22 | |
| | 469.9875 | 46.55 | 1.00 | 47.55 | 4.35 | 51.90 | 154.88 | |
| TX4 | 406.1125 | 36.27 | 1.00 | 37.27 | 4.35 | 41.62 | 14.52 | 16.60 |
| | 413.05 | 36.44 | 1.00 | 37.44 | 4.35 | 41.79 | 15.10 | |
| | 419.9875 | 36.37 | 1.00 | 37.37 | 4.35 | 41.72 | 14.86 | |
| | 421.0125 | 36.55 | 1.00 | 37.55 | 4.35 | 41.90 | 15.49 | |
| | 445 | 36.24 | 1.00 | 37.24 | 4.35 | 41.59 | 14.42 | |
| | 469.9875 | 36.85 | 1.00 | 37.85 | 4.35 | 42.20 | 16.60 | |

Note:
1. Output Power(dBm)= Measured power(dBm)+ Tolerance(dB)
2. Antenna Gain(dBd)= Antenna Gain(dBi)-2.15, Antenna Gain(dBi)=6.5 dBi
3. ERP(dBm)= Output Power (dBm)+ Antenna Gain (dBd)
4. ERP(W)= $\{10^{ERP(dBm)/10}\}/1000$

DC 13.6V:

| Operation Mode | Test Frequency (MHz) | Measured power (dBm) | Difference ( dB ) | Limit (dB) | Result |
|---|---|---|---|---|---|
| TX1 | 406.1125 | 46.56 | -0.16 | -1 ~ +1 | Pass |
| | 413.05 | 46.67 | -0.05 | | |
| | 419.9875 46.79 | | 0.06 | | |
| | 421.0125 46.85 | | 0.13 | | |
| | 445 46.76 | | 0.03 | | |
| | 469.9875 | 46.66 | -0.06 | | |
| TX2 | 406.1125 | 36.81 | -0.18 | -1 ~ +1 | Pass |
| | 413.05 | 36.66 | -0.33 | | |
| | 419.9875 | 36.94 | -0.05 | | |
| | 421.0125 37.01 | | 0.02 | | |
| | 445 | 36.82 | -0.17 | | |
| | 469.9875 | 36.71 | -0.28 | | |
| TX3 | 406.1125 | 46.48 | -0.24 | -1 ~ +1 | Pass |
| | 413.05 46.84 | | 0.11 | | |
| | 419.9875 | 46.65 | -0.07 | | |
| | 421.0125 | 46.50 | -0.22 | | |
| | 445 | 46.32 | -0.40 | | |
| | 469.9875 | 46.66 | -0.06 | | |
| TX4 | 406.1125 | 36.36 | -0.63 | -1 ~ +1 | Pass |
| | 413.05 | 36.53 | -0.46 | | |
| | 419.9875 | 36.46 | -0.53 | | |
| | 421.0125 | 36.64 | -0.35 | | |
| | 445 | 36.33 | -0.66 | | |
| | 469.9875 | 36.94 | -0.05 | | |

Maximum ERP:

| Operation Mode | Test Frequency (MHz) | Measured power (dBm) | Tolerance (dB) | Output Power (dBm) | Antenna Gain (dBd) | ERP (dBm) | ERP (W) | Max ERP (W) |
|---|---|---|---|---|---|---|---|---|
| TX1 | 406.1125 | 46.56 | 1.00 | 47.56 | 4.35 | 51.91 | 155.41 | 165.96 |
| | 413.05 | 46.67 | 1.00 | 47.67 | 4.35 | 52.02 | 159.40 | |
| | 419.9875 | 46.79 | 1.00 | 47.79 | 4.35 | 52.14 | 163.50 | |
| | 421.0125 | 46.85 | 1.00 | 47.85 | 4.35 | 52.20 | 165.96 | |
| | 445 | 46.76 | 1.00 | 47.76 | 4.35 | 52.11 | 162.37 | |
| | 469.9875 | 46.66 | 1.00 | 47.66 | 4.35 | 52.01 | 159.04 | |
| TX2 | 406.1125 | 36.81 | 1.00 | 37.81 | 4.35 | 42.16 | 16.45 | 17.22 |
| | 413.05 | 36.66 | 1.00 | 37.66 | 4.35 | 42.01 | 15.89 | |
| | 419.9875 | 36.94 | 1.00 | 37.94 | 4.35 | 42.29 | 16.95 | |
| | 421.0125 | 37.01 | 1.00 | 38.01 | 4.35 | 42.36 | 17.22 | |
| | 445 | 36.82 | 1.00 | 37.82 | 4.35 | 42.17 | 16.48 | |
| | 469.9875 | 36.71 | 1.00 | 37.71 | 4.35 | 42.06 | 16.07 | |
| TX3 | 406.1125 | 46.48 | 1.00 | 47.48 | 4.35 | 51.83 | 152.56 | 165.41 |
| | 413.05 | 46.84 | 1.00 | 47.84 | 4.35 | 52.19 | 165.41 | |
| | 419.9875 | 46.65 | 1.00 | 47.65 | 4.35 | 52.00 | 158.67 | |
| | 421.0125 | 46.50 | 1.00 | 47.50 | 4.35 | 51.85 | 153.27 | |
| | 445 | 46.32 | 1.00 | 47.32 | 4.35 | 51.67 | 147.03 | |
| | 469.9875 | 46.66 | 1.00 | 47.66 | 4.35 | 52.01 | 159.04 | |
| TX4 | 406.1125 | 36.36 | 1.00 | 37.36 | 4.35 | 41.71 | 14.82 | 16.95 |
| | 413.05 | 36.53 | 1.00 | 37.53 | 4.35 | 41.88 | 15.42 | |
| | 419.9875 | 36.46 | 1.00 | 37.46 | 4.35 | 41.81 | 15.17 | |
| | 421.0125 | 36.64 | 1.00 | 37.64 | 4.35 | 41.99 | 15.81 | |
| | 445 | 36.33 | 1.00 | 37.33 | 4.35 | 41.68 | 14.72 | |
| | 469.9875 | 36.94 | 1.00 | 37.94 | 4.35 | 42.29 | 16.95 | |

Note:

1. Output Power(dBm)= Measured power(dBm)+ Tolerance(dB)
2. Antenna Gain(dBd)= Antenna Gain(dBi)-2.15, Antenna Gain(dBi)=6.5 dBi
3. ERP(dBm)= Output Power (dBm)+ Antenna Gain (dBd)
4. ERP(W)= $\{10^{\wedge \frac{ERP(dBm)}{10}}\}/1000$

## 4.2. Occupied Bandwidth

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits.

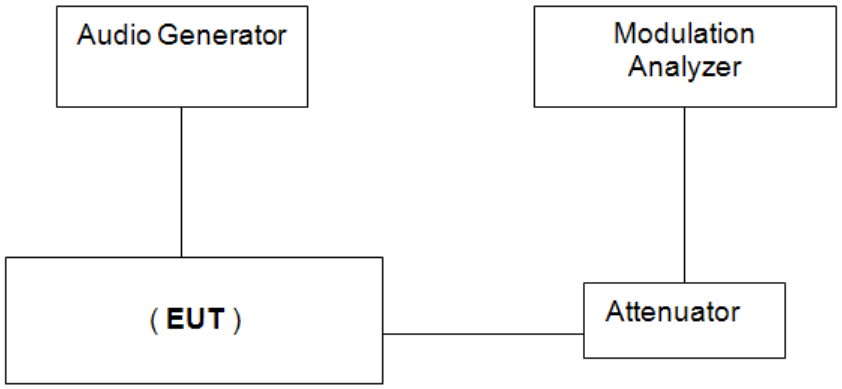
**LIMIT**

**FCC Part 90.209，FCC Part 90.210，FCC Part 80.207，FCC Part 74.462，FCC Part 22.731，FCC Part 22.357，FCC Part 2.1049**

Bandwidth limitations:

| Frequency band (MHz) | Channel spacing (kHz) | Authorized bandwidth (kHz) |
|---|---|---|
| Below 252 | | |
| 25-50 | 20 | 20 |
| 72-76 | 20 | 20 |
| 150-174 | 17.5 | 1 320/11.25/6 |
| 216-2205 | 6.25 | 20/11.25/6 |
| 220-222 | 5 | 4 |
| 406-5122 | 16.25 | 1 320/11.25/6 |
| 806-809/851-854 | 12.5 | 20 |
| 809-824/854-869 | 25 | 20 |
| 896-901/935-940 | 12.5 | 13.6 |
| 902-9284 | | |
| 929-930 | 25 | 20 |
| 1427-14325 | 12.5 | 12.5 |
| 32450-2483.52 | | |
| Above 25002 | | |

**TEST CONFIGURATION**




**TEST PROCEDURE**

1 The EUT was modulated by 2.5kHz Sine wave audio signal; the level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation. Rated system deviation is 2.5 kHz (12.5kHz channel spacing).
2 Set EUT as normal operation.
Set SPA Center Frequency = fundamental frequency, RBW=100Hz, VBW=300Hz, span=50kHz for 12.5kHz channel spacing.
3 Set SPA Max hold. Mark peak, Set 99% Occupied Bandwidth and 26dB Occupied Bandwidth.
4 Set SPA Center Frequency=fundamental frequency, set =100Hz, VBW=300Hz, span=50kHz for 12.5kHz channel spacing.

**TEST MODE:**

Please reference to the section 2.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

We tested TX1 to TX3 for AC 120V and DC 13.6V, recorded worst case TX1 and TX3 for AC 120V.

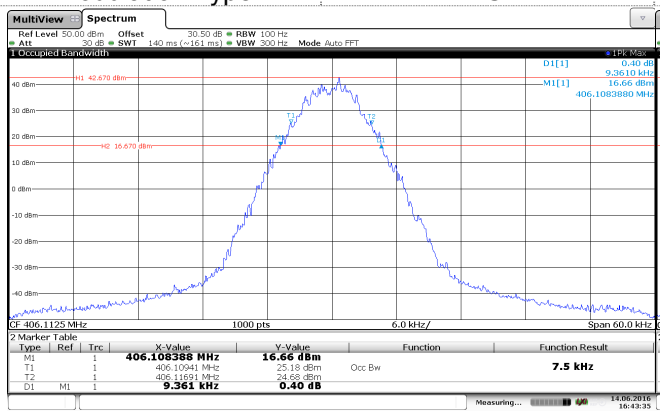
*Please refer to the below test data:*

| Operation Mode | Test Frequency (MHz) | Occupied Bandwidth (kHz) | | Limit(kHz) | Result |
|---|---|---|---|---|---|
| | | 99% | 26dB | | |
| TX1 | 406.1125 | 7.50 | 9.36 | ≤11.25 | Pass |
| | 413.05 | 7.50 | 9.31 | | |
| | 419.9875 | 7.50 | 9.52 | | |
| | 421.0125 | 7.50 | 9.52 | | |
| | 445 | 7.50 | 9.52 | | |
| | 469.9875 | 7.50 | 9.41 | | |
| TX3 | 406.1125 | 6.12 | 8.17 | ≤11.25 | Pass |
| | 413.05 | 6.12 | 8.12 | | |
| | 419.9875 | 6.12 | 8.12 | | |
| | 421.0125 | 6.12 | 8.17 | | |
| | 445 | 6.12 | 7.96 | | |
| | 469.9875 | 6.12 | 8.17 | | |

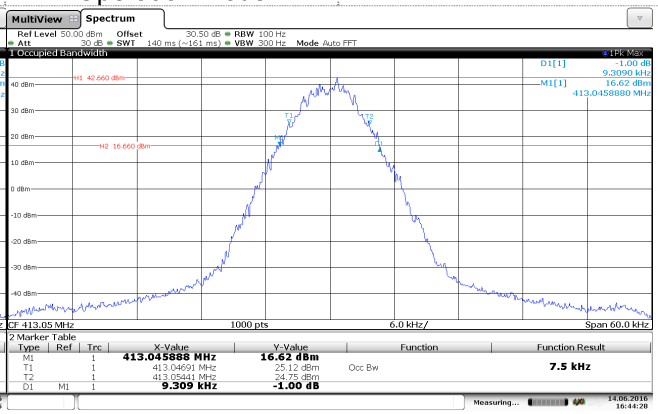
**The equipment applicable to 12.5kHz Channel Bandwidth.**

Test plot as follows:

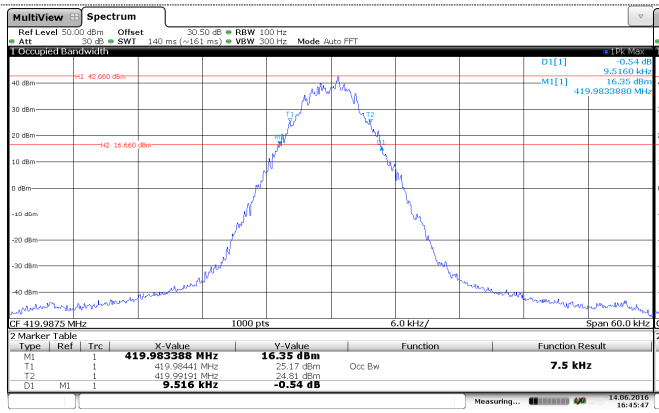
| Modulation Type | 4FSK | Operation Mode | TX1 |
|---|---|---|---|



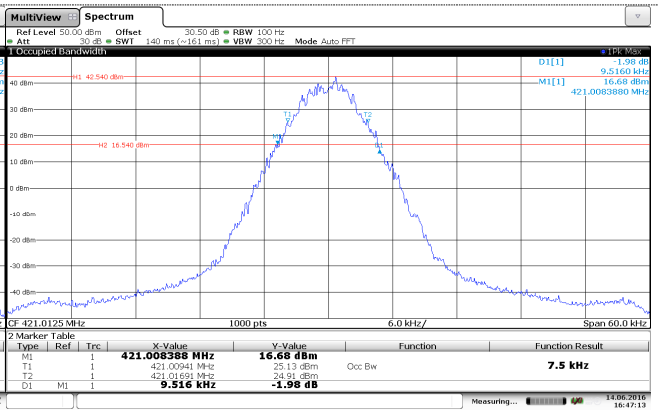

406.1125MHz



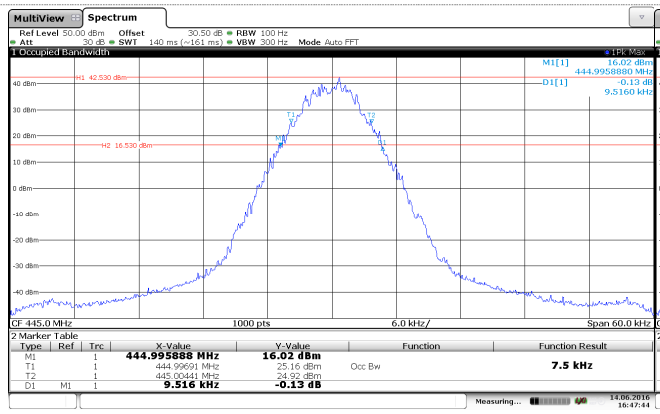

413.0500MHz



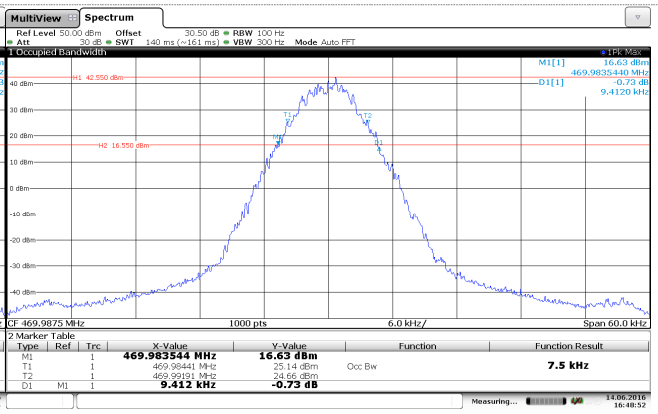

419.9875MHz




421.0125MHz

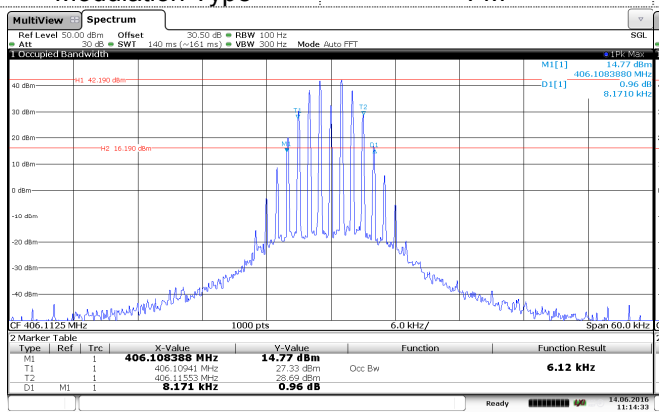



445.0000MHz

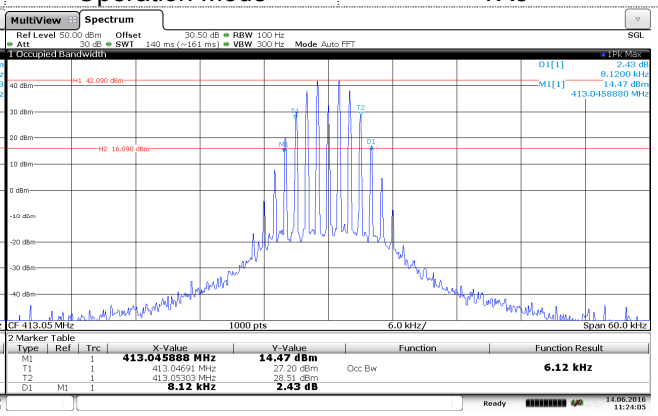



469.9875MHz

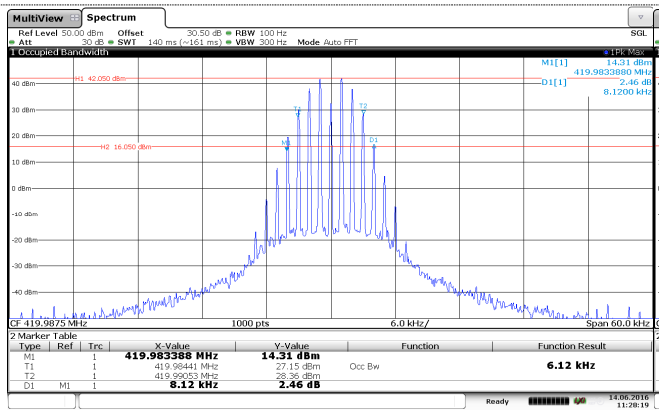
| Modulation Type | FM | Operation Mode | TX3 |
|---|---|---|---|



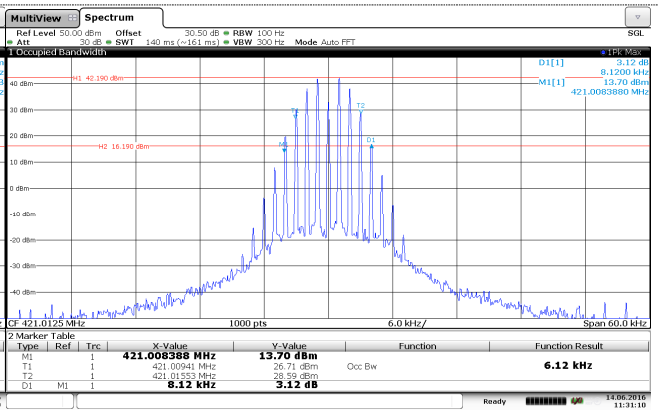

406.1125MHz



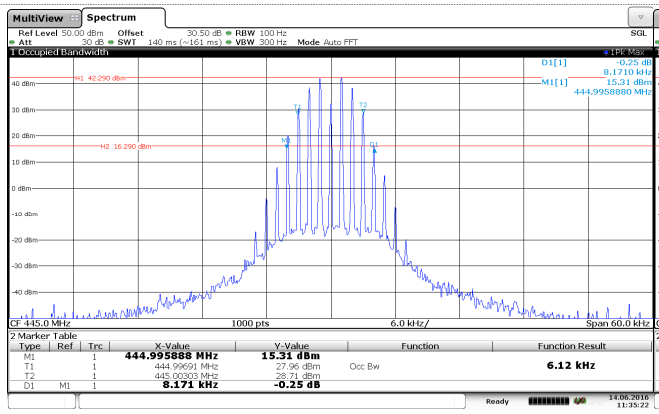

413.0500MHz



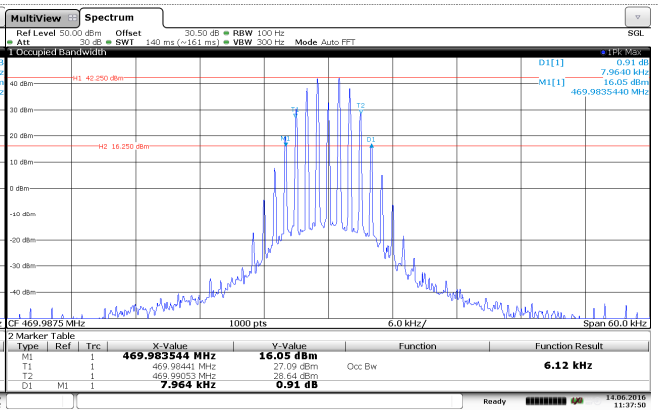

419.9875MHz




421.0125MHz




445.0000MHz




469.9875MHz

## 4.3. Emission Mask

Transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section.

**LIMIT**

**FCC Part 90.209，FCC Part 90.210，FCC Part 80.207，FCC Part 74.462，FCC Part 22.731，FCC Part 22.357，FCC Part 2.1049**

| Frequency band (MHz) | Mask for equipment with audio low pass filter | Mask for equipment without audio low pass filter |
|---|---|---|
| Below 251 | A or B | A or C |
| 25-50 | B | C |
| 72-76 | B | C |
| 150-1742 | B, D, or E | C, D or E |
| 150 paging only | B | C |
| 220-222 | F | F |
| 421-5122 5 | B, D, or E | C, D, or E |
| 450 paging only | B | G |
| 806-809/851-854 | B | H |
| 809-824/854-8693 5 | B | G |
| 896-901/935-940 | I | J |
| 902-928 | K | K |
| 929-930 | B | G |
| 4940-4990 MHz | L or M | L or M |
| 5850-59254 | | |
| All other bands | B | C |

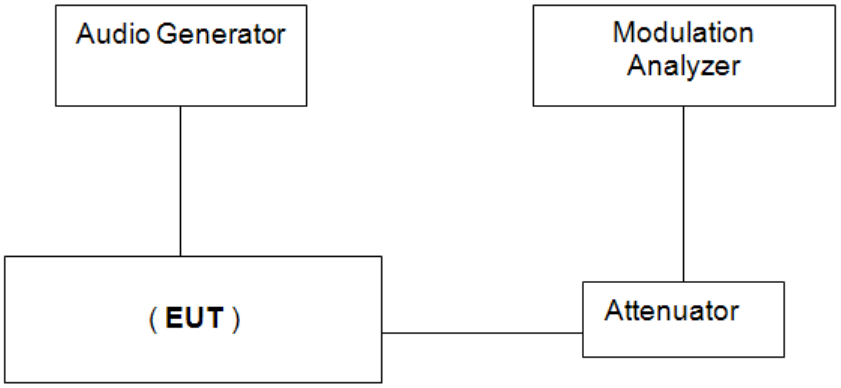
(d) Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from $f_0$: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27($f_d$−2.88 kHz) dB.

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

**TEST CONFIGURATION**



**TEST PROCEDURE**

1. The EUT was modulated by 2.5kHz Sine wave audio signal; the level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation. Rated system deviation is 2.5 kHz (12.5kHz channel spacing) .
2. Set EUT as normal operation.
   Set SPA Center Frequency = fundamental frequency, RBW=100Hz, VBW=300Hz,span=50kHz for 12.5KHz channel spacing.

**TEST MODE:**

Please reference to the section 2.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

*Please refer to the below test data:*

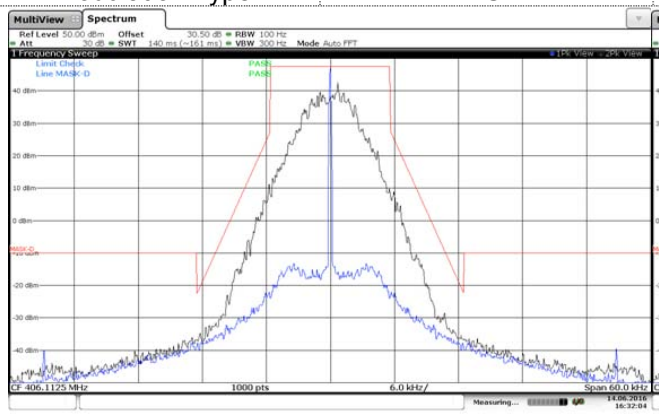
*Note:*
*1)The equipment applicable to Emission Mask D.*

*2)* We tested TX1 to TX3 for AC 120V and DC 13.6V, recorded worst case TX1 and TX3 for AC 120V.

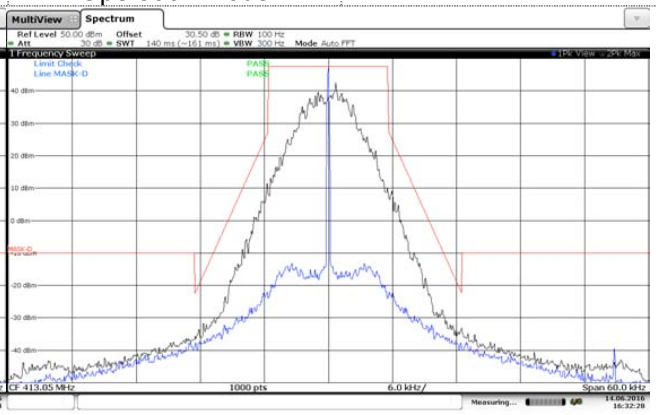
| Operation Mode | Test Frequency (MHz) | RBW (Hz) | Applicable Mask | Result |
|---|---|---|---|---|
| TX1 | 406.1125 | 100.00 | D | Pass |
| | 413.05 | | | |
| | 419.9875 | | | |
| | 421.0125 | | | |
| | 445 | | | |
| | 469.9875 | | | |
| TX3 | 406.1125 | 100.00 | D | Pass |
| | 413.05 | | | |
| | 419.9875 | | | |
| | 421.0125 | | | |
| | 445 | | | |
| | 469.9875 | | | |

Test plot as follows:

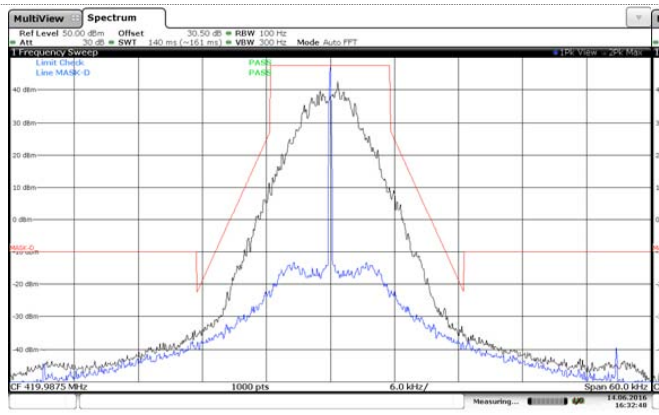
| Modulation Type | 4FSK | Operation Mode | TX1 |
|---|---|---|---|



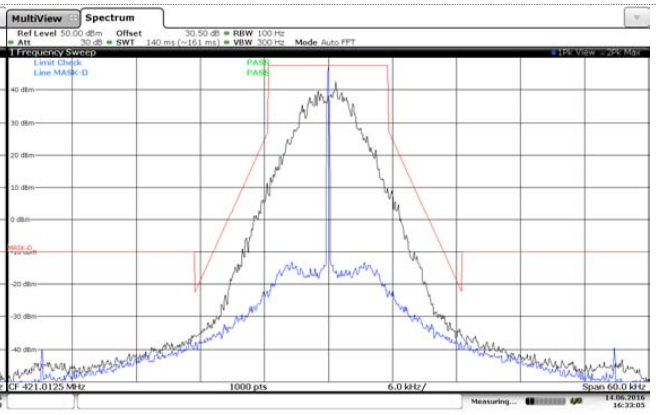

406.1125MHz



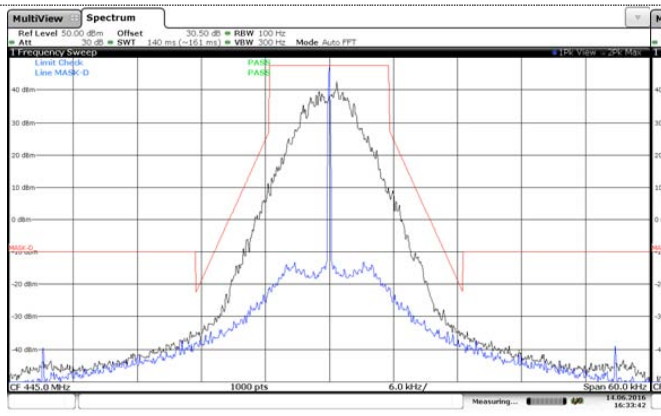

413.0500MHz



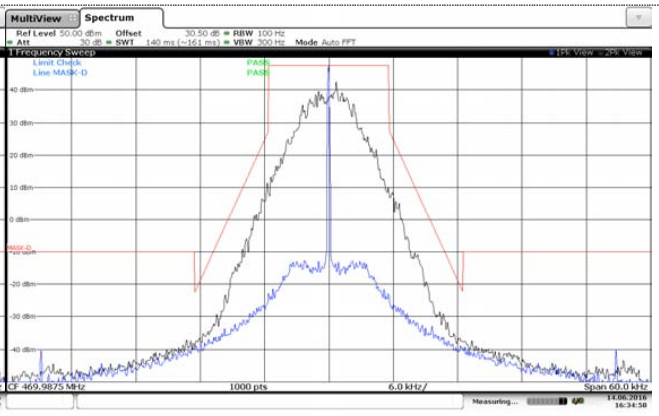

419.9875MHz




421.0125MHz

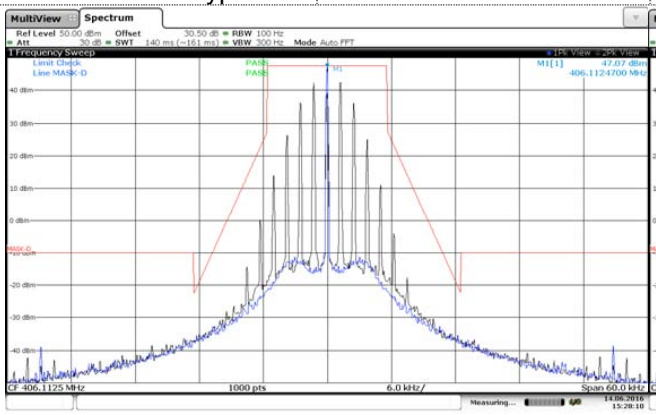



445.0000MHz

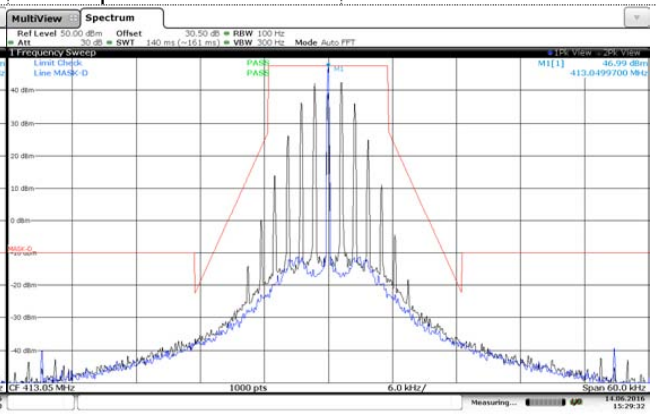



469.9875MHz

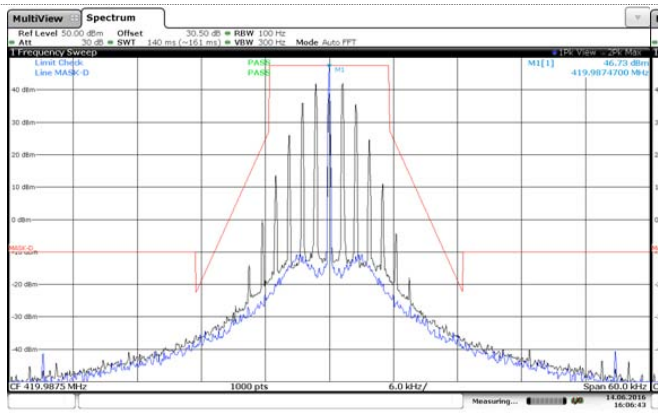
| Modulation Type | FM | Operation Mode | TX3 |
|---|---|---|---|



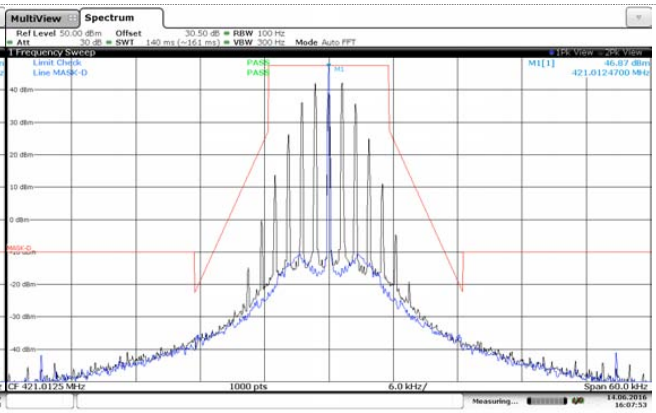
406.1125MHz



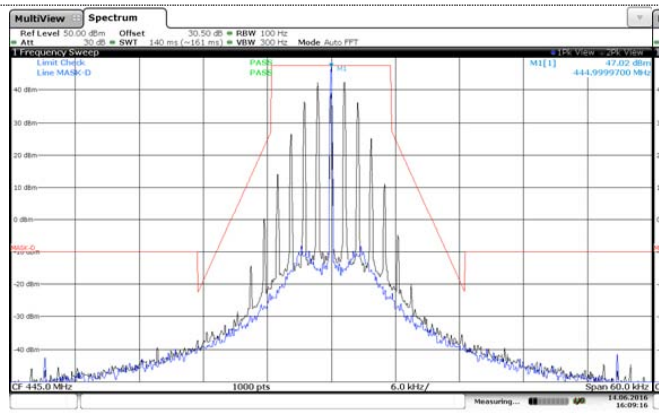
413.0500MHz



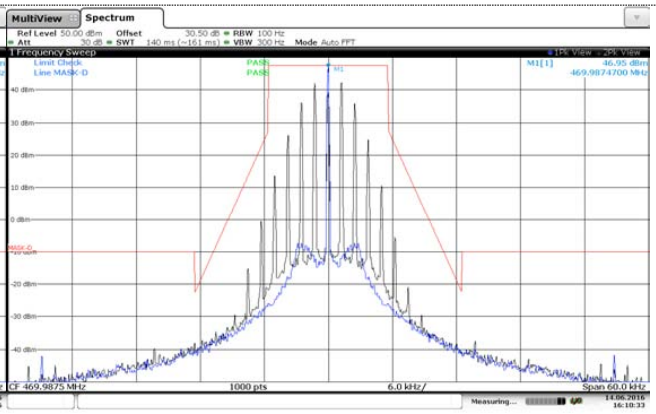
419.9875MHz



421.0125MHz



445.0000MHz



469.9875MHz

## 4.4. Modulation Charcateristics

Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted.

**LIMIT**

**FCC Part 90.207，FCC Part 80.213，FCC Part 74.463，FCC Part 2.1047(a)**

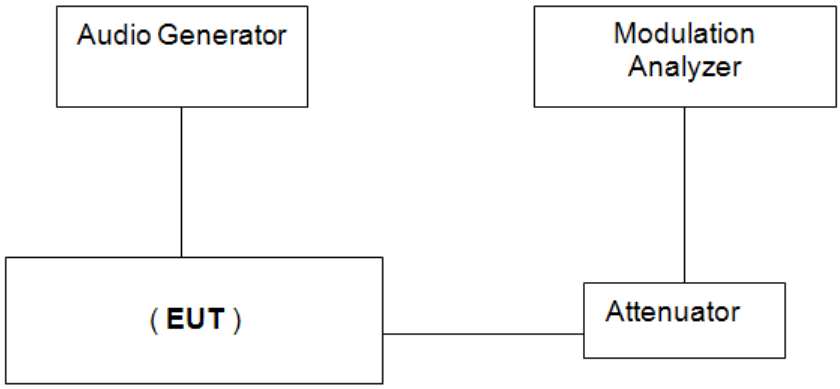
**1. Modulation Limit:**

1) Configure the EUT as shown in figure, adjust the audio input for 60% of rated system deviation at 1kHz using this level as a reference (0dB) and vary the input level from –20 to +20dB. Record the frequency deviation obtained as a function of the input level.
2) Repeat step 1 with input frequency changing to 300, 1004, 1500 and 2500Hz in sequence.

**2. Audio Frequency Response:**

1) Configure the EUT as shown in figure .
2) Adjust the audio input for 20% of rated system deviation at 1kHz using this level as a reference.
3) Vary the Audio frequency from 300Hz to 3 kHz and record the frequency deviation.
4) Audio Frequency Response =$20\log_{10}$ ($V_{FREQ}/V_{REF}$).

**TEST CONFIGURATION**




**TEST MODE:**

Please reference to the section 2.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

Remark:

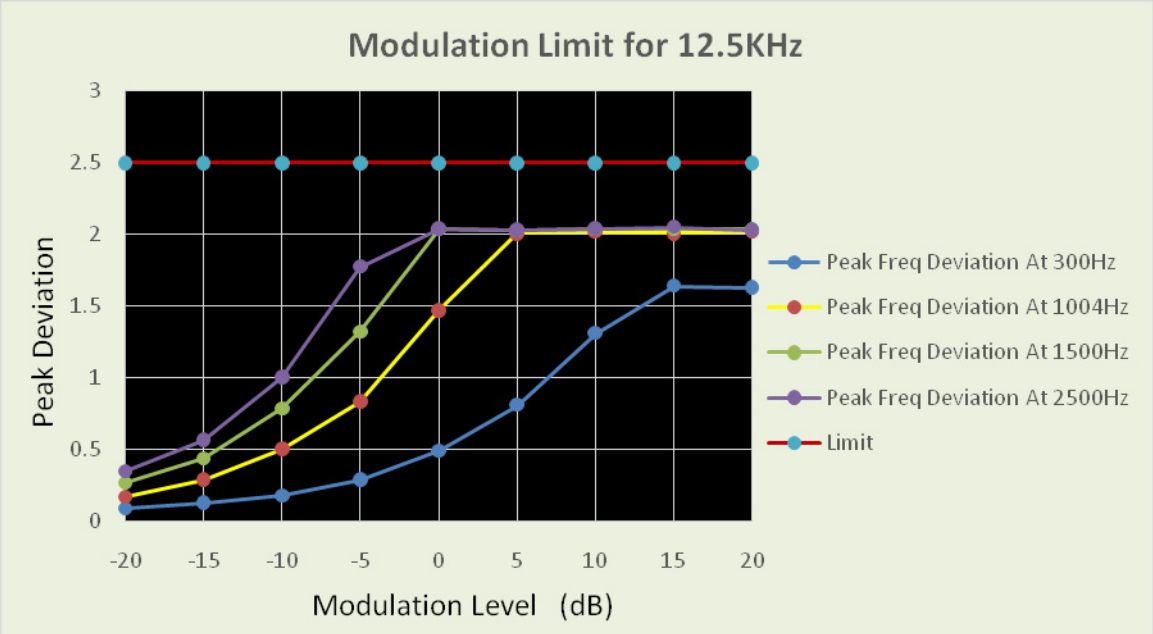
*1)We tested AC 120V and DC 13.6V, recorded worst case for AC 120V.*
2)We tested TX3 to TX4.recorded worst case at TX3 for 445MHz.

*Please refer to the below test data:*

**a).Modulation Limit:**

| TX3: 445MHz | | | | | | |
|---|---|---|---|---|---|---|
| Modulation Level (dB) | Peak Freq. Deviation At 300Hz (kHz) | Peak Freq. Deviation At 1004Hz (kHz) | Peak Freq. Deviation At 1500Hz (kHz) | Peak Freq. Deviation At 2500 Hz (kHz) | Limit (kHz) | Result |
| -20 0.09 | | 0.18 | 0.27 0.35 | | 2.5 Pass | |
| -15 0.13 | | 0.29 | 0.44 0.57 | | | |
| -10 0.18 | | 0.51 | 0.79 1.01 | | | |
| -5 0.29 | | 0.84 | 1.33 | 1.78 | | |
| 0 0.49 | | 1.47 | 2.04 | 2.04 | | |
| 5 0.81 | | 2.01 | 2.03 | 2.03 | | |
| 10 1.31 | | 2.02 | 2.04 | 2.04 | | |
| 15 1.64 | | 2.01 | 2.04 | 2.05 | | |
| 20 1.63 | | 2.02 | 2.04 | 2.03 | | |

Test plot as follows:



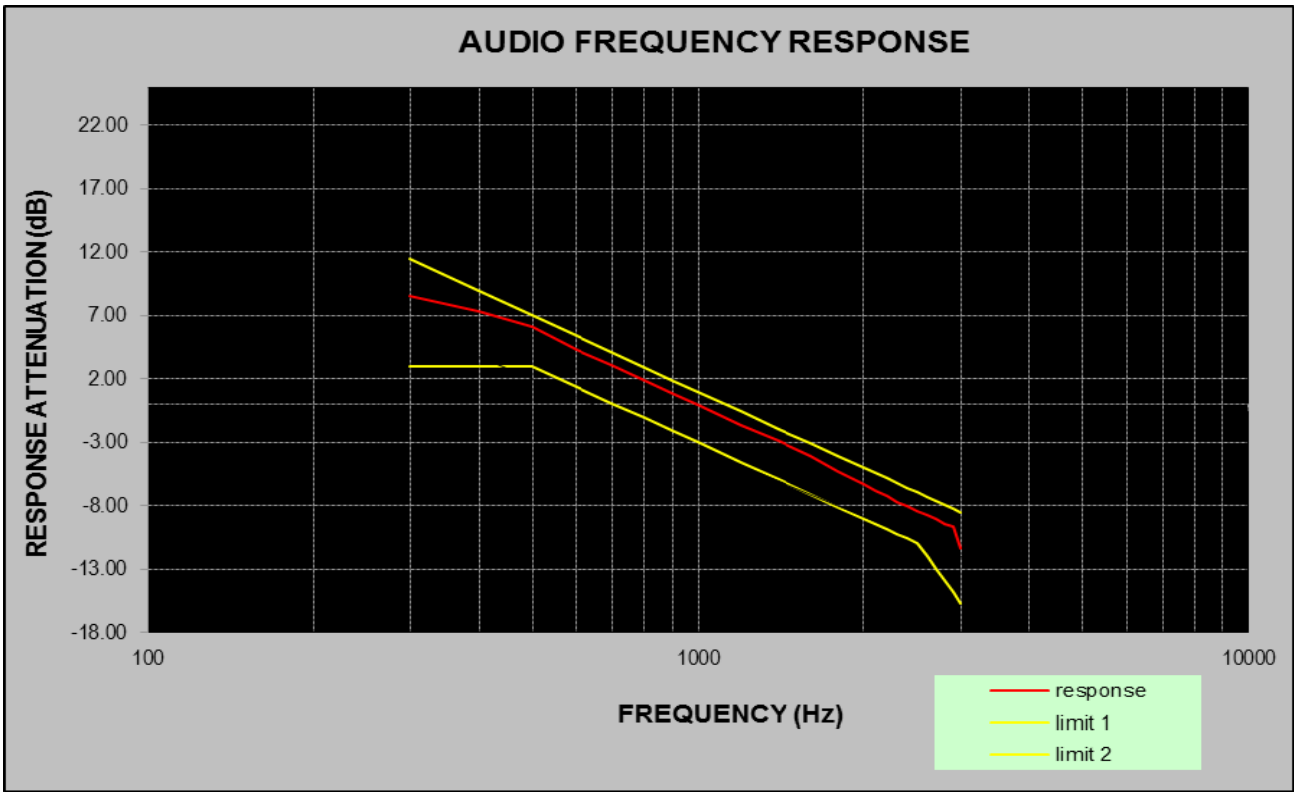
**b). Audio Frequency Response:**

**Method of Measurement:**

The audio frequency response was measured in accordance with TIA/EIA Specification 603 with no exception. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 300-3000Hz shall be submitted and Audio Post Limiter Low Pass Filter Response from 3.0kHz to 50kHz.However, the audio frequency response should test from 100Hz to 5.0 kHz according to FCC Part 2.1047(a).**Note:**The Audio Frequency Response is identical for 12.5 kHz channel separation

| TX3:445MHz | | | |
|---|---|---|---|
| Frequency (Hz ) | Audio Frequency Response (dB) | Frequency (Hz ) | Audio Frequency Response (dB) |
| 300 8.50 | | 2000 | -6.33 |
| 400 7.36 | | 2100 | -6.80 |
| 500 6.12 | | 2200 | -7.21 |
| 600 4.28 | | 2300 | -7.68 |
| 700 3.09 | | 2400 | -8.07 |
| 800 1.89 | | 2500 | -8.41 |
| 900 0.89 | | 2600 | -8.72 |
| 1000 0.00 | | 2700 | -9.05 |
| 1200 -1.62 | | 2800 | -9.40 |
| 1400 -2.88 | | 2900 | -9.67 |
| 1600 -4.12 | | 3000 | -11.32 |
| 1800 -5.28 | | | |

Test plot as follows:



## 4.5. Frequency Stability Test

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

**LIMIT**

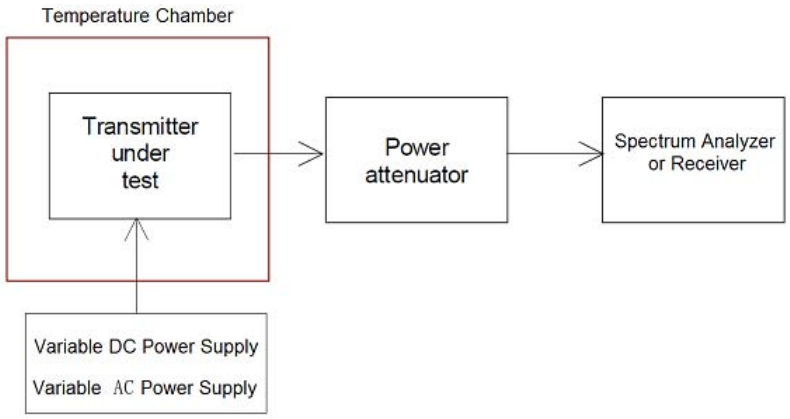
**FCC Part 90.213，FCC Part 80.209，FCC Part 74.464，FCC Part 22.355，FCC Part 2.1055**

| Frequency range (MHz) | Fixed and base stations | Mobile stations | |
|---|---|---|---|
| | | Over 2 watts output power | 2 watts or less output power |
| Below 25 | 1 2 3100 | 100 | 200 |
| 25-50 | 20 | 20 | 50 |
| 72-76 | 5 | | 50 |
| 150-174 | 5 115 | 65 | 4 650 |
| 216-220 | 1.0 | | 1.0 |
| 220-22212 | 0.1 | 1.5 | 1.5 |
| 421-512 | 7 11 142.5 | 85 | 85 |
| 806-809 | 141.0 | 1.5 | 1.5 |
| 809-824 | 141.5 | 2.5 | 2.5 |
| 851-854 | 1.0 | 1.5 | 1.5 |
| 854-869 | 1.5 | 2.5 | 2.5 |
| 896-901 | 140.1 | 1.5 | 1.5 |
| 902-928 | 2.5 | 2.5 | 2.5 |
| 902-92813 | 2.5 | 2.5 | 2.5 |
| 929-930 | 1.5 | | |
| 935-940 | 0.1 | 1.5 | 1.5 |
| 1427-1435 | 9300 | 300 | 300 |
| Above 245010 | | | |

**TEST PROCEDURE**

1. According to FCC Part 2 Section 2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30℃ to +50℃ centigrade.
2. According to FCC Part 2 Section 2.1055 (d) (2), for battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacture.
3. Vary primary supply voltage from 85 to 115 percent of the nominal value.
4. The EUT was set in the climate chamber and connected to an external DC/AC power supply. The RF output was directly connected to Spectrum Analyzer The coupling loss of the additional cables was recorded and taken in account for all the measurements. After temperature stabilization (approx. 20 min for each stage), the frequency for the lower, the middle and the highest frequency range was recorded. For Frequency stability Vs. Voltage the EUT was connected to a DC/AC power supply and the voltage was adjusted in the required ranges. The result was recorded.

**TEST CONFIGURATION**



**TEST MODE:**

Please reference to the section 2.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

*Please refer to the below test data:*

| TX1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Test conditions | | Frequency error (ppm) | | | | | | Limit (ppm) | Result |
| Voltage (V) | Temp (℃) | 406.1125 MHz | 413.05 MHz | 419.9875 MHz | 421.0125 MHz | 445 MHz | 469.9875 MHz | | |
| 120 | -30 | 0.34 | 0.35 | 0.35 | 0.35 | 0.34 | 0.31 | 2.5 | Pass |
| | -20 | 0.32 | 0.33 | 0.36 | 0.36 | 0.33 | 0.31 | | |
| | -10 | 0.34 | 0.35 | 0.35 | 0.36 | 0.33 | 0.33 | | |
| | 0 | 0.32 | 0.34 | 0.37 | 0.35 | 0.33 | 0.33 | | |
| | 10 | 0.33 | 0.33 | 0.34 | 0.35 | 0.32 | 0.31 | | |
| | 20 | 0.35 | 0.36 | 0.37 | 0.36 | 0.34 | 0.34 | | |
| | 30 | 0.37 | 0.38 | 0.39 | 0.39 | 0.37 | 0.35 | | |
| | 40 | 0.39 | 0.39 | 0.41 | 0.40 | 0.39 | 0.38 | | |
| | 50 | 0.40 | 0.39 | 0.43 | 0.44 | 0.41 | 0.41 | | |
| 102 (85% Rated) | 20 | 0.33 | 0.33 | 0.37 | 0.33 | 0.33 | 0.34 | | |
| 138 (115% Rated) | 20 | 0.37 | 0.36 | 0.39 | 0.40 | 0.37 | 0.35 | | |

| TX2 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Test conditions | | Frequency error (ppm) | | | | | | Limit (ppm) | Result |
| Voltage(V) | Temp (℃) | 406.1125 MHz | 413.05 MHz | 419.9875 MHz | 421.0125 MHz | 445 MHz | 469.9875 MHz | | |
| 120 | -30 | 0.33 | 0.34 | 0.34 | 0.35 | 0.34 | 0.30 | 2.5 | Pass |
| | -20 | 0.35 | 0.35 | 0.34 | 0.35 | 0.31 | 0.32 | | |
| | -10 | 0.33 | 0.35 | 0.35 | 0.36 | 0.34 | 0.31 | | |
| | 0 | 0.36 | 0.35 | 0.35 | 0.35 | 0.33 | 0.32 | | |
| | 10 | 0.34 | 0.35 | 0.34 | 0.35 | 0.34 | 0.32 | | |
| | 20 | 0.36 | 0.36 | 0.36 | 0.36 | 0.34 | 0.33 | | |
| | 30 | 0.37 | 0.36 | 0.37 | 0.38 | 0.37 | 0.35 | | |
| | 40 | 0.40 | 0.36 | 0.38 | 0.41 | 0.38 | 0.35 | | |
| | 50 | 0.43 | 0.38 | 0.40 | 0.41 | 0.41 | 0.37 | | |
| 102 (85% Rated) | 20 | 0.34 | 0.35 | 0.33 | 0.36 | 0.32 | 0.33 | | |
| 138 (115% Rated) | 20 | 0.38 | 0.36 | 0.36 | 0.39 | 0.34 | 0.36 | | |

| TX3 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Test conditions | | Frequency error (ppm) | | | | | | Limit (ppm) | Result |
| Voltage(V) | Temp (℃) | 406.1125 MHz | 413.05 MHz | 419.9875 MHz | 421.0125 MHz | 445 MHz | 469.9875 MHz | | |
| 120 | -30 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.24 | 2.5 | Pass |
| | -20 | 0.26 | 0.25 | 0.25 | 0.27 | 0.25 | 0.26 | | |
| | -10 | 0.26 | 0.25 | 0.27 | 0.27 | 0.26 | 0.25 | | |
| | 0 | 0.26 | 0.26 | 0.26 | 0.25 | 0.27 | 0.25 | | |
| | 10 | 0.25 | 0.26 | 0.26 | 0.25 | 0.27 | 0.26 | | |
| | 20 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.26 | | |
| | 30 | 0.27 | 0.28 | 0.27 | 0.29 | 0.29 | 0.27 | | |
| | 40 | 0.29 | 0.29 | 0.28 | 0.30 | 0.31 | 0.28 | | |
| | 50 | 0.31 | 0.32 | 0.29 | 0.30 | 0.31 | 0.29 | | |
| 102 (85% Rated) | 20 | 0.24 | 0.26 | 0.26 | 0.25 | 0.25 | 0.26 | | |
| 138 (115% Rated) | 20 | 0.28 | 0.29 | 0.28 | 0.28 | 0.27 | 0.27 | | |

| TX4 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Test conditions | | Frequency error (ppm) | | | | | | Limit (ppm) | Result |
| Voltage(V) | Temp (℃) | 406.1125 MHz | 413.05 MHz | 419.9875 MHz | 421.0125 MHz | 445 MHz | 469.9875 MHz | | |
| 120 | -30 | 0.25 | 0.26 | 0.26 | 0.27 | 0.28 | 0.28 | ±2.5 | Pass |
| | -20 | 0.27 | 0.25 | 0.25 | 0.25 | 0.27 | 0.27 | | |
| | -10 | 0.26 | 0.27 | 0.25 | 0.25 | 0.28 | 0.26 | | |
| | 0 | 0.25 | 0.26 | 0.27 | 0.27 | 0.28 | 0.28 | | |
| | 10 | 0.27 | 0.27 | 0.25 | 0.27 | 0.29 | 0.27 | | |
| | 20 | 0.27 | 0.27 | 0.27 | 0.27 | 0.30 | 0.29 | | |
| | 30 | 0.28 | 0.29 | 0.27 | 0.30 | 0.30 | 0.29 | | |
| | 40 | 0.29 | 0.29 | 0.29 | 0.30 | 0.32 | 0.30 | | |
| | 50 | 0.29 | 0.29 | 0.31 | 0.31 | 0.32 | 0.32 | | |
| 102 (85% Rated) | 20 | 0.27 | 0.27 | 0.26 | 0.25 | 0.30 | 0.26 | | |
| 138 (115% Rated) | 20 | 0.30 | 0.28 | 0.29 | 0.28 | 0.32 | 0.31 | | |

| TX1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Test conditions | | Frequency error (ppm) | | | | | | Limit (ppm) | Result |
| Voltage (V) | Temp (℃) | 406.1125 MHz | 413.05 MHz | 419.9875 MHz | 421.0125 MHz | 445 MHz | 469.9875 MHz | | |
| 13.6 | -30 | 0.36 | 0.33 | 0.37 | 0.39 | 0.36 | 0.32 | 2.5 | Pass |
| | -20 | 0.36 | 0.35 | 0.35 | 0.37 | 0.36 | 0.31 | | |
| | -10 | 0.36 | 0.33 | 0.36 | 0.40 | 0.39 | 0.34 | | |
| | 0 | 0.39 | 0.35 | 0.36 | 0.40 | 0.36 | 0.33 | | |
| | 10 | 0.39 | 0.33 | 0.37 | 0.39 | 0.37 | 0.34 | | |
| | 20 | 0.39 | 0.36 | 0.37 | 0.40 | 0.39 | 0.34 | | |
| | 30 | 0.41 | 0.37 | 0.38 | 0.40 | 0.39 | 0.35 | | |
| | 40 | 0.41 | 0.40 | 0.39 | 0.40 | 0.41 | 0.36 | | |
| | 50 | 0.42 | 0.41 | 0.42 | 0.41 | 0.42 | 0.38 | | |
| 11.56 (85% Rated) | 20 | 0.35 | 0.35 | 0.34 | 0.39 | 0.39 | 0.34 | | |
| 15.64 (115% Rated) | 20 | 0.39 | 0.38 | 0.38 | 0.42 | 0.39 | 0.37 | | |

| TX2 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Test conditions | | Frequency error (ppm) | | | | | | Limit (ppm) | Result |
| Voltage(V) | Temp (℃) | 406.1125 MHz | 413.05 MHz | 419.9875 MHz | 421.0125 MHz | 445 MHz | 469.9875 MHz | | |
| 13.6 | -30 | 0.27 | 0.27 | 0.33 | 0.30 | 0.29 | 0.28 | 2.5 | Pass |
| | -20 | 0.27 | 0.26 | 0.34 | 0.28 | 0.28 | 0.29 | | |
| | -10 | 0.27 | 0.26 | 0.33 | 0.29 | 0.29 | 0.29 | | |
| | 0 | 0.26 | 0.27 | 0.34 | 0.28 | 0.30 | 0.28 | | |
| | 10 | 0.27 | 0.26 | 0.34 | 0.28 | 0.30 | 0.29 | | |
| | 20 | 0.28 | 0.27 | 0.36 | 0.30 | 0.30 | 0.30 | | |
| | 30 | 0.30 | 0.28 | 0.36 | 0.32 | 0.31 | 0.32 | | |
| | 40 | 0.32 | 0.28 | 0.36 | 0.33 | 0.32 | 0.34 | | |
| | 50 | 0.33 | 0.30 | 0.36 | 0.34 | 0.35 | 0.35 | | |
| 11.56 (85% Rated) | 20 | 0.26 | 0.26 | 0.34 | 0.29 | 0.30 | 0.27 | | |
| 15.64 (115% Rated) | 20 | 0.30 | 0.30 | 0.37 | 0.32 | 0.31 | 0.31 | | |

| TX3 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Test conditions | | Frequency error (ppm) | | | | | | Limit (ppm) | Result |
| Voltage(V) | Temp (℃) | 406.1125 MHz | 413.05 MHz | 419.9875 MHz | 421.0125 MHz | 445 MHz | 469.9875 MHz | | |
| 13.6 | -30 | 0.24 | 0.27 | 0.25 | 0.26 | 0.22 | 0.26 | 2.5 Pass | |
| | -20 | 0.25 | 0.27 | 0.25 | 0.26 | 0.24 | 0.24 | | |
| | -10 | 0.23 | 0.26 | 0.25 | 0.27 | 0.24 | 0.26 | | |
| | 0 | 0.24 | 0.26 | 0.24 | 0.26 | 0.24 | 0.26 | | |
| | 10 | 0.24 | 0.24 | 0.26 | 0.27 | 0.23 | 0.25 | | |
| | 20 | 0.25 | 0.27 | 0.26 | 0.27 | 0.24 | 0.26 | | |
| | 30 | 0.26 | 0.28 | 0.26 | 0.27 | 0.25 | 0.27 | | |
| | 40 | 0.26 | 0.30 | 0.26 | 0.29 | 0.25 | 0.27 | | |
| | 50 | 0.29 | 0.30 | 0.28 | 0.30 | 0.28 | 0.29 | | |
| 11.56 (85% Rated) | 20 | 0.24 | 0.27 | 0.24 | 0.27 | 0.22 | 0.25 | | |
| 15.64 (115% Rated) | 20 | 0.25 | 0.28 | 0.26 | 0.29 | 0.26 | 0.29 | | |

| TX4 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Test conditions | | Frequency error (ppm) | | | | | | Limit (ppm) | Result |
| Voltage(V) | Temp (℃) | 406.1125 MHz | 413.05 MHz | 419.9875 MHz | 421.0125 MHz | 445 MHz | 469.9875 MHz | | |
| 13.6 | -30 | 0.30 | 0.29 | 0.26 | 0.26 | 0.27 | 0.27 | ±2.5 Pass | |
| | -20 | 0.29 | 0.29 | 0.25 | 0.25 | 0.26 | 0.28 | | |
| | -10 | 0.31 | 0.27 | 0.23 | 0.25 | 0.27 | 0.27 | | |
| | 0 | 0.31 | 0.28 | 0.25 | 0.27 | 0.26 | 0.27 | | |
| | 10 | 0.30 | 0.28 | 0.25 | 0.26 | 0.25 | 0.28 | | |
| | 20 | 0.31 | 0.29 | 0.26 | 0.27 | 0.27 | 0.29 | | |
| | 30 | 0.33 | 0.32 | 0.26 | 0.29 | 0.29 | 0.29 | | |
| | 40 | 0.33 | 0.34 | 0.28 | 0.30 | 0.31 | 0.32 | | |
| | 50 | 0.35 | 0.37 | 0.29 | 0.30 | 0.31 | 0.32 | | |
| 11.56 (85% Rated) | 20 | 0.28 | 0.27 | 0.24 | 0.27 | 0.26 | 0.29 | | |
| 15.64 (115% Rated) | 20 | 0.31 | 0.30 | 0.27 | 0.29 | 0.29 | 0.29 | | |

## 4.6. Transmitter Frequency Behaviour

**LIMIT**

**FCC part 90.214**

Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

| Time intervals[1 2] | Maximum frequency difference[3] | All equipment | |
|---|---|---|---|
| | | 150 to 174 MHz | 421 to 512 MHz |
| Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels | | | |
| $t_1$[4] | ±25.0 kHz | 5.0 ms | 10.0 ms |
| $t_2$ | ±12.5 kHz | 20.0 ms | 25.0 ms |
| $t_3$[4] | ±25.0 kHz | 5.0 ms | 10.0 ms |
| Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels | | | |
| $t_1$[4] | ±12.5 kHz | 5.0 ms | 10.0 ms |
| $t_2$ | ±6.25 kHz | 20.0 ms | 25.0 ms |
| $t_3$[4] | ±12.5 kHz | 5.0 ms | 10.0 ms |
| Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels | | | |
| $t_1$[4] | ±6.25 kHz | 5.0 ms | 10.0 ms |
| $t_2$ | ±3.125 kHz | 20.0 ms | 25.0 ms |
| $t_3$[4] | ±6.25 kHz | 5.0 ms | 10.0 ms |

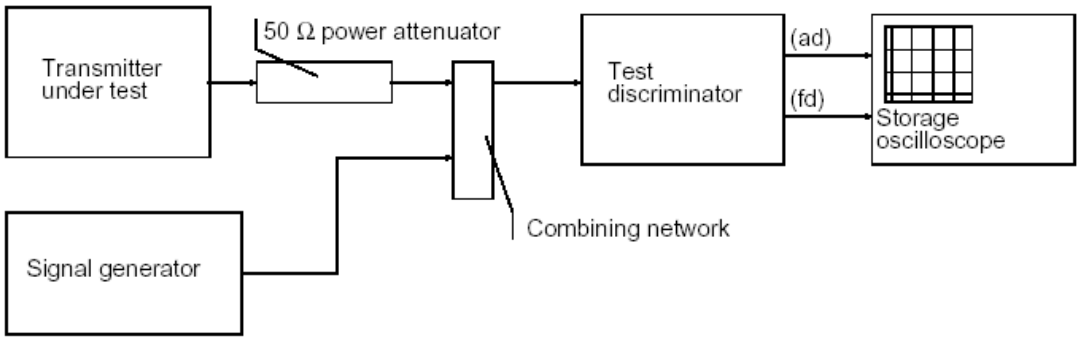
Note:

1. On is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

1) t $_1$ is the time period immediately following ton.
2) t $_2$ is the time period immediately following $t_1$.
3) t $_3$ is the time period from the instant when the transmitter is turned off until toff.
4) t $_{off}$ is the instant when the 1 kHz test signal starts to rise.

2. During the time from the end of $t_2$ to the beginning of $t_3$, the frequency difference must not exceed the limits specified in § 90.213.
3. Difference between the actual transmitter frequency and the assigned transmitter frequency.
4. If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

**TEST CONFIGURATION**



**TEST PROCEDURE**

According to TIA/EIA-603 2.2.19 requirement.As for the product different from PTT,we use test steps as follows:

1. Connect DUT into Test discriminator and Storage Oscilloscope and keep DUT stats ON;
2. Input 1kHz signal into DUT;
3. Set the modulation domain analyzer to trigger on the rising edge of the waveform in order to capture a single-shot turn-on of the transmitter signals;
4. Keep DUT in OFF state and Key the PTT;
5. Observe the stored oscilloscope of modulation domain analyzer.The signal trace shall be maintained within the allowable limits during the periods $t_1$ and $t_2$,and shall also remain within limits following $t_2$;
6. Adjust the modulation domain anzlyzer to trigger on the falling edge of the transmitter waveform in order to capture a single-shot turn-off transmitter of the transmitter signal.
7. Keep the digital portable radio in ON state and Unkey the PTT;
8. Observe the stored oscilloscope of modulation domain analyzer.The signal trace shall be maintained within the allowable limits during the period $t_3$.

**TEST MODE:**

Please reference to the section 2.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

Note:

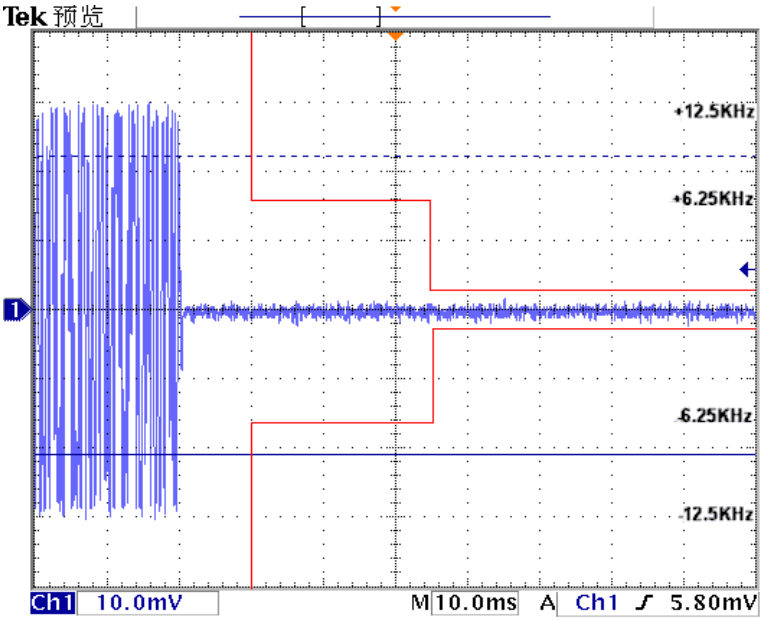
1)We tested AC 120V and DC 13.6V, recorded worst case for AC 120V.

2)We tested TX3 to TX4,recorded worst case at TX3 for 445MHz.

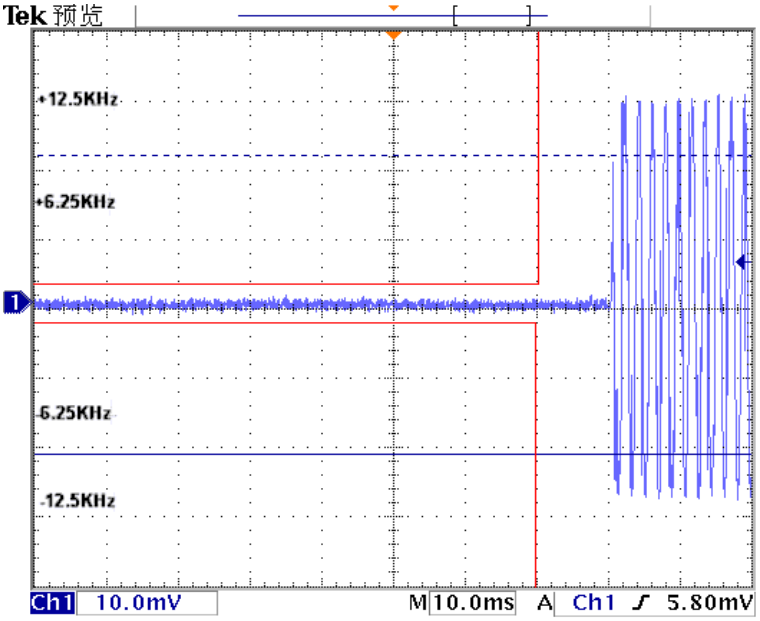
Please refer to the following plots:

Modulation Type: FM(TX3)

Transmitter Frequency Behaviour @ 12.5kHz Channel Separation------Off – On




Transmitter Frequency Behaviour @ 12.5kHz Channel Separation------On – Off



## 4.7. Spurious Emission on Antenna Port

Conducted spurious emissions are emissions at the antenna terminals on a frequency or frequencies that are outside a band sufficient to ensure transmission of information of required quality for the class of communication desired

**LIMIT**

FCC Part 90.210，FCC Part 80.211，FCC Part 74.461，FCC Part 22.861，FCC Part 2.1051 (12.5 kHz Bandwidth only):

On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 12.5 kHz at least:
High: 50 + 10 log (Pwatts) = 50 + 10 log (40.93) =66.12dB

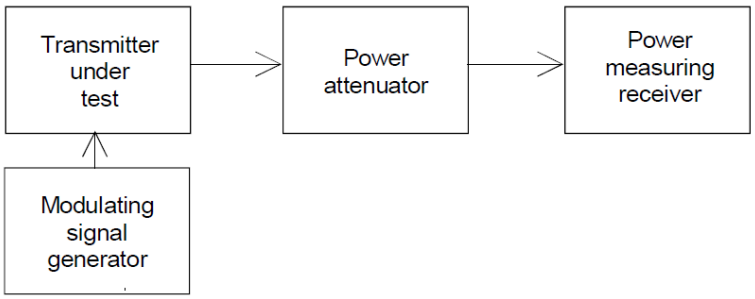
Note: In general, the worse case attenuation requirement shown above was applied.
Calculation: Limit (dBm) =EL-50-10log10 (TP)

Notes: EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is 46.02 dBm.
Limit (dBm) =46.02-50-10log$_{10}$ (40.93) = -20dBm

**TEST PROCEDURE**

1. The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation.
2. The resolution bandwidth of the spectrum analyzer was set to 100 kHz. Sufficient scans were taken to show any out of band emission up to 10$^{th}$. Harmonic for the lower and the highest frequency range. Set RBW 100 kHz, VBW 300 kHz in the frequency band 30MHz to 1GHz,while set RBW=1MHz.VBW=3MHz from the 1GHz to 10$^{th}$ Harmonic.
3. The audio input was set to 0 to get the unmodulated carrier, the resulting picture is print out for each channel separation.

**TEST CONFIGURATION**




**TEST MODE:**

Please reference to the section 2.4

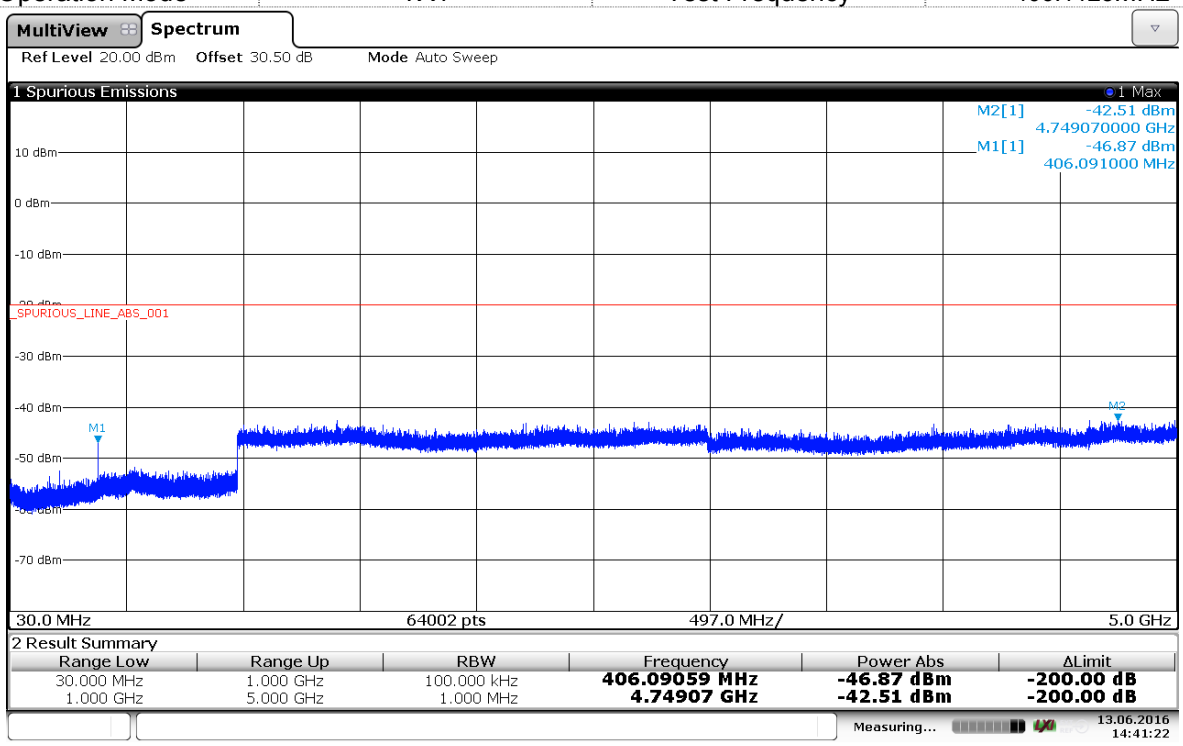
**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

Note:
1. In general, the worse case attenuation requirement shown above was applied.
2. The measurement frequency range from 30 MHz to 5GHz.
3. We tested TX1 to TX3 for AC 120V and DC 13.6V, recorded worst case TX1 and TX3 for AC 120V.

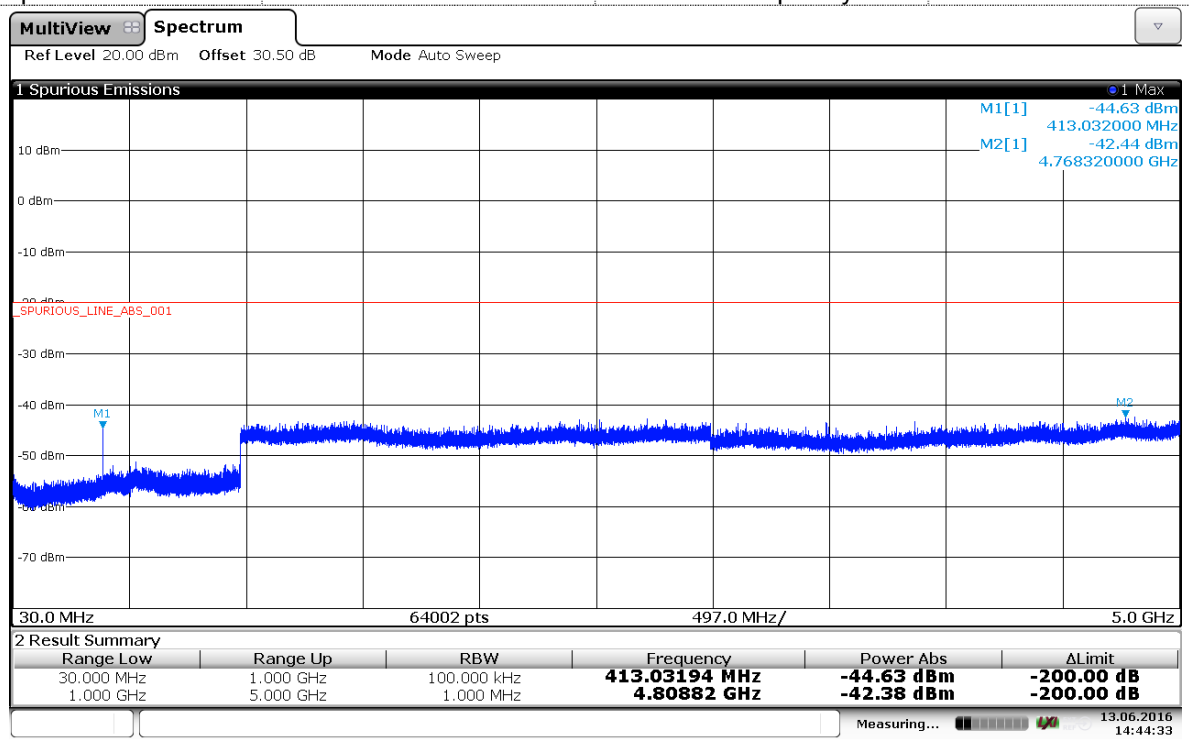
Test plot as follows:

| Operation Mode | TX1 | Test Frequency | 406.1125MHz |
|---|---|---|---|



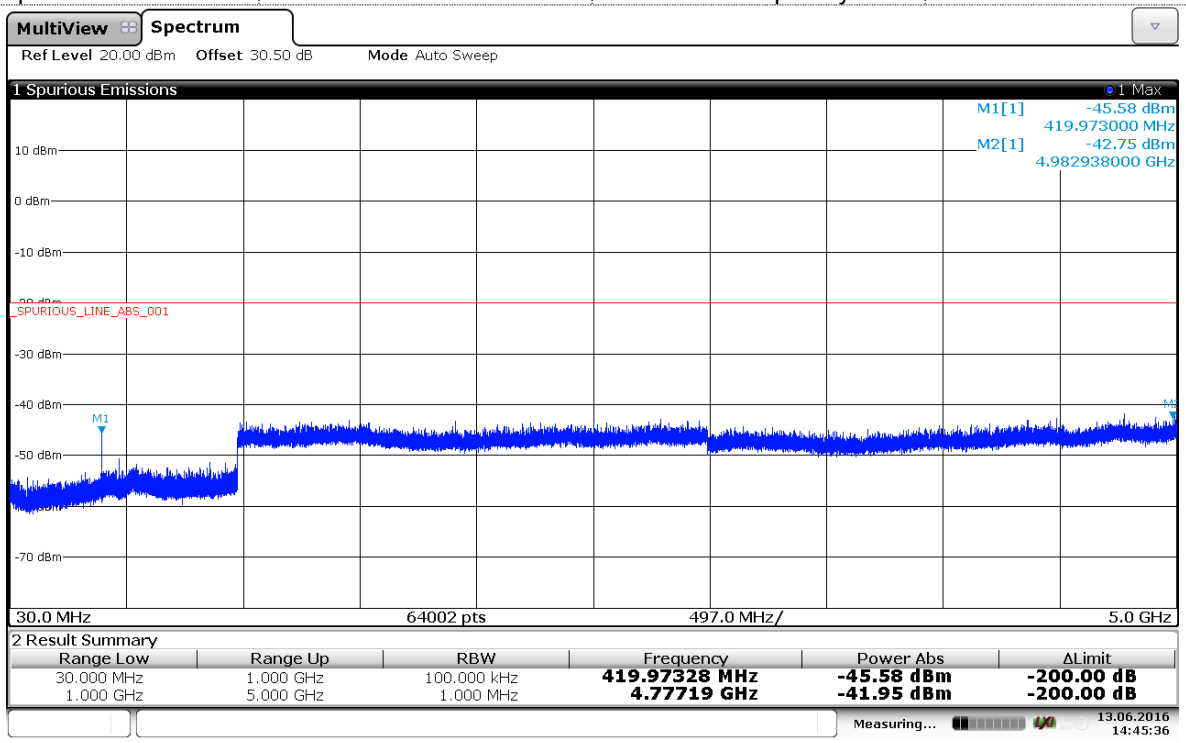

30MHz-5GHz

| Operation Mode | TX1 | Test Frequency | 413.05MHz |
|---|---|---|---|



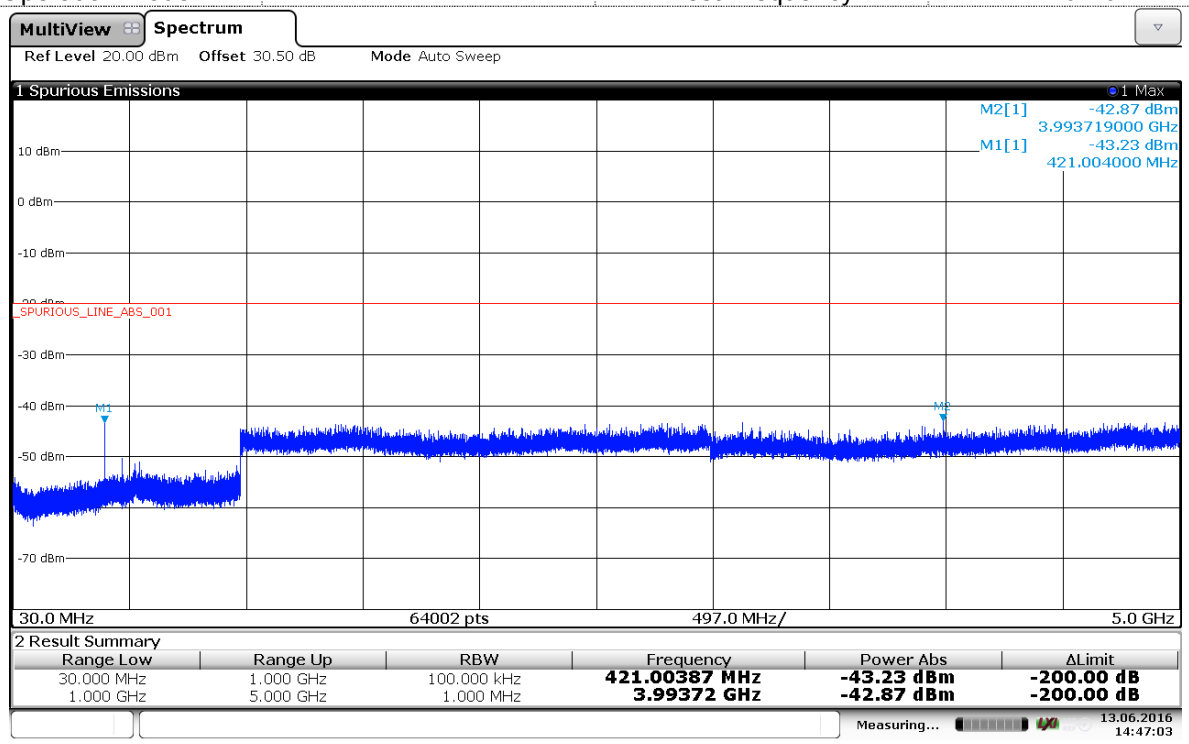

30MHz-5GHz

| Operation Mode | TX1 | Test Frequency | 419.9875MHz |
|---|---|---|---|



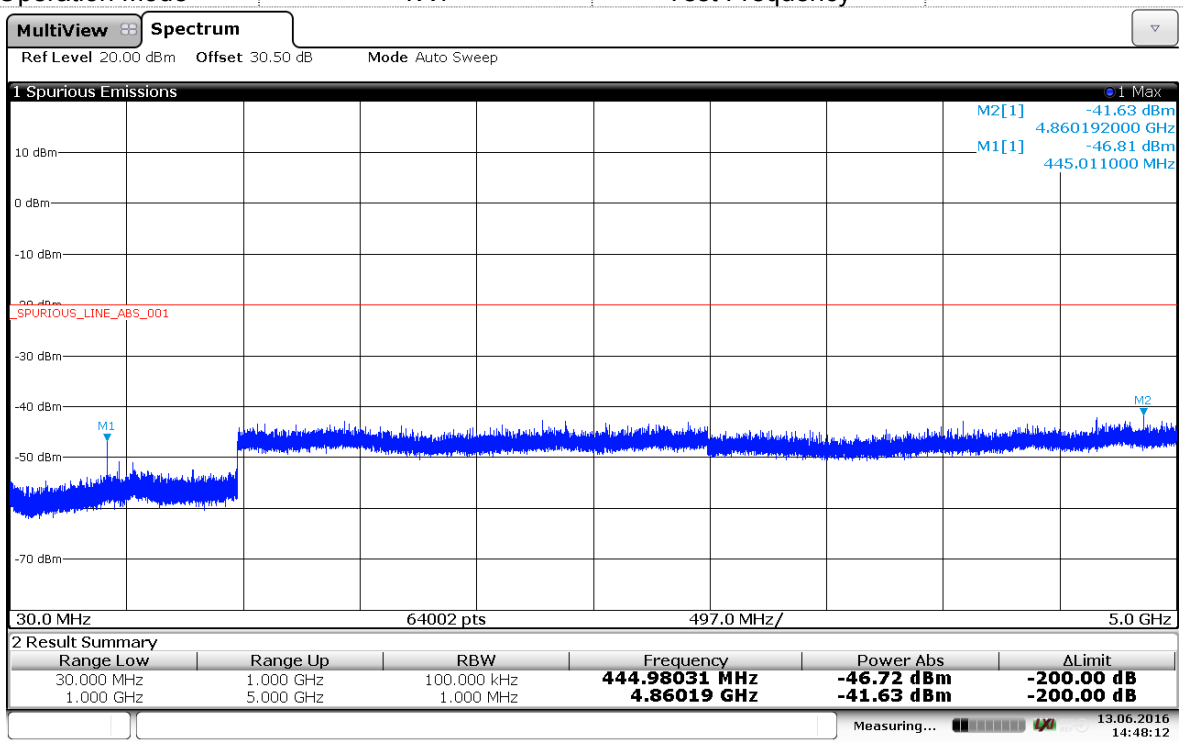

30MHz-5GHz

| Operation Mode | TX1 | Test Frequency | 421.0125MHz |
|---|---|---|---|



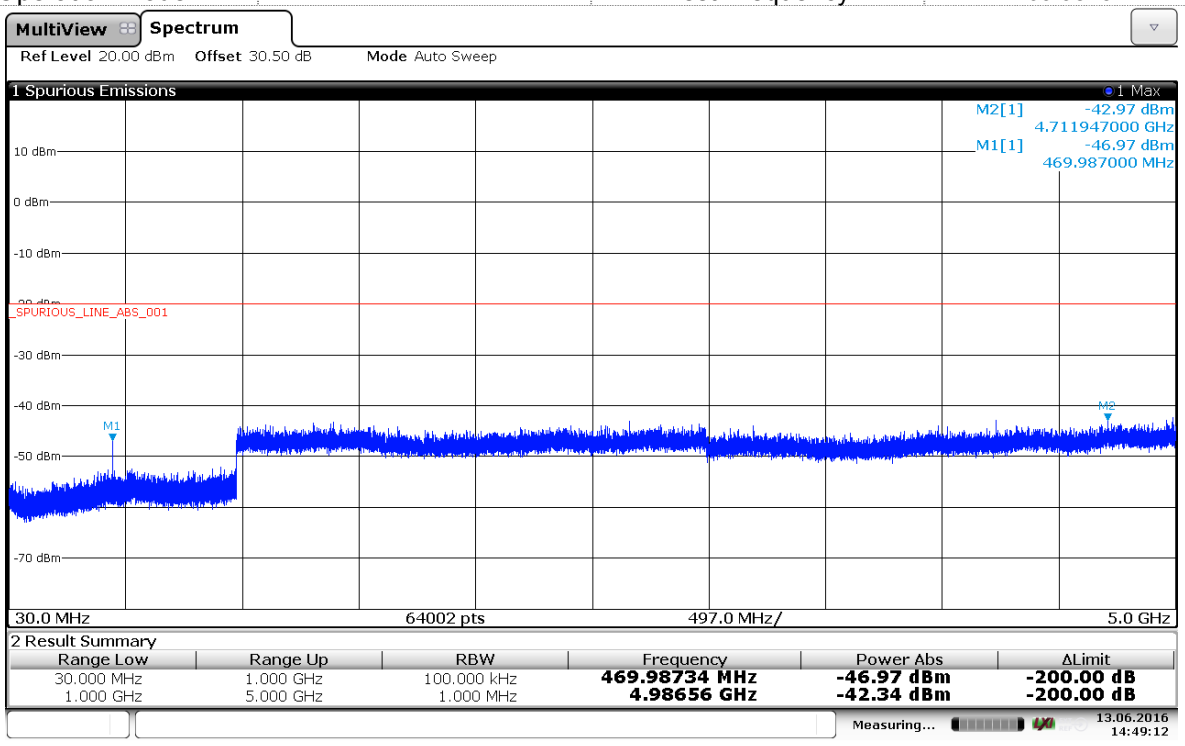

30MHz-5GHz

| Operation Mode | TX1 | Test Frequency | 445MHz |
|---|---|---|---|



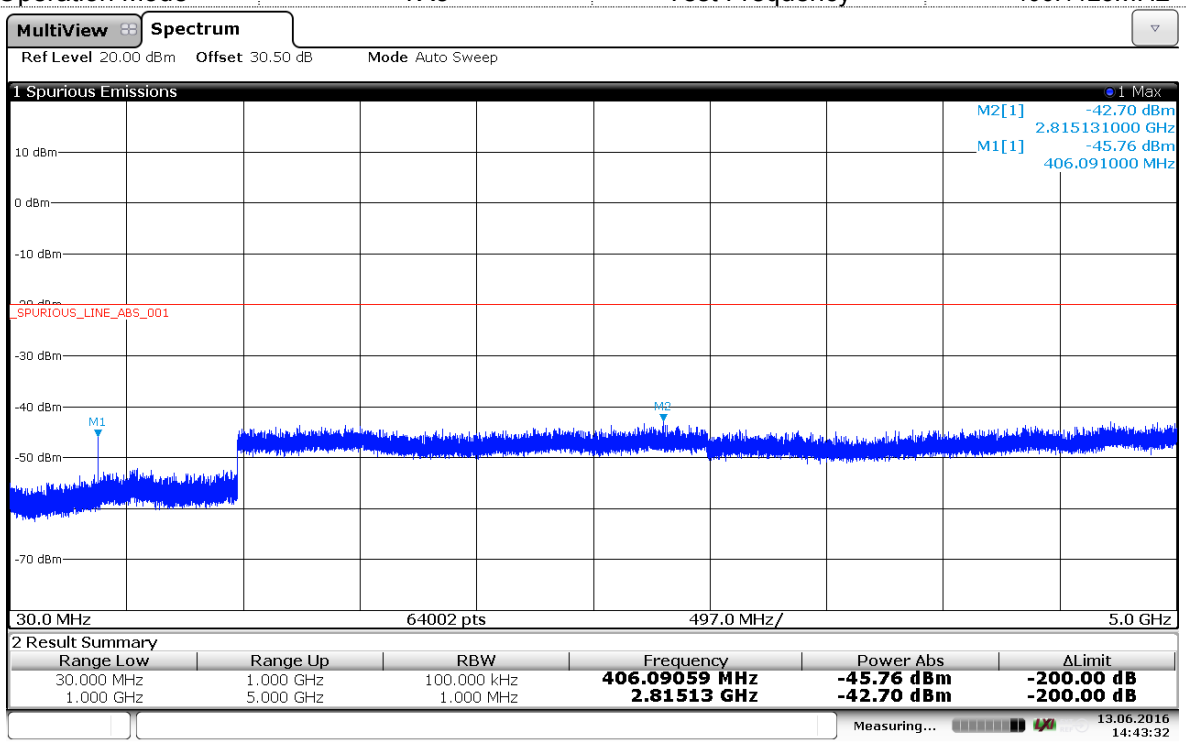

30MHz-5GHz

| Operation Mode | TX1 | Test Frequency | 469.9875MHz |
|---|---|---|---|



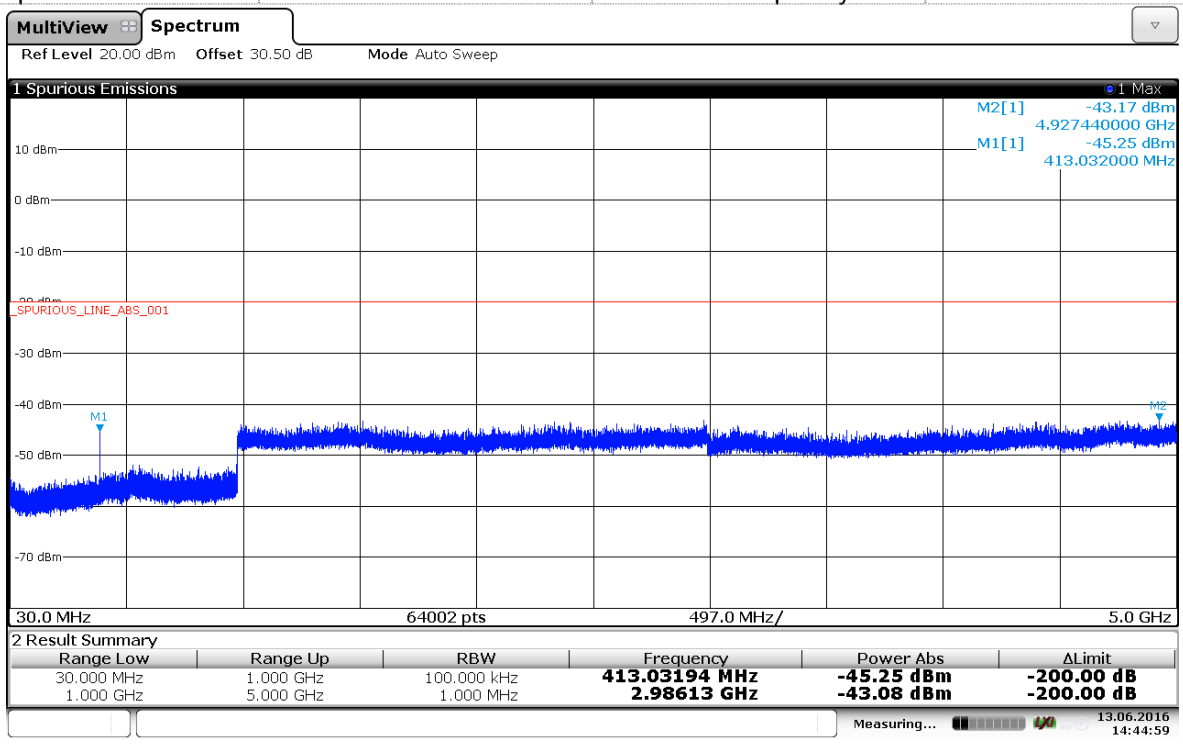

30MHz-5GHz

| Operation Mode | TX3 | Test Frequency | 406.1125MHz |
|---|---|---|---|



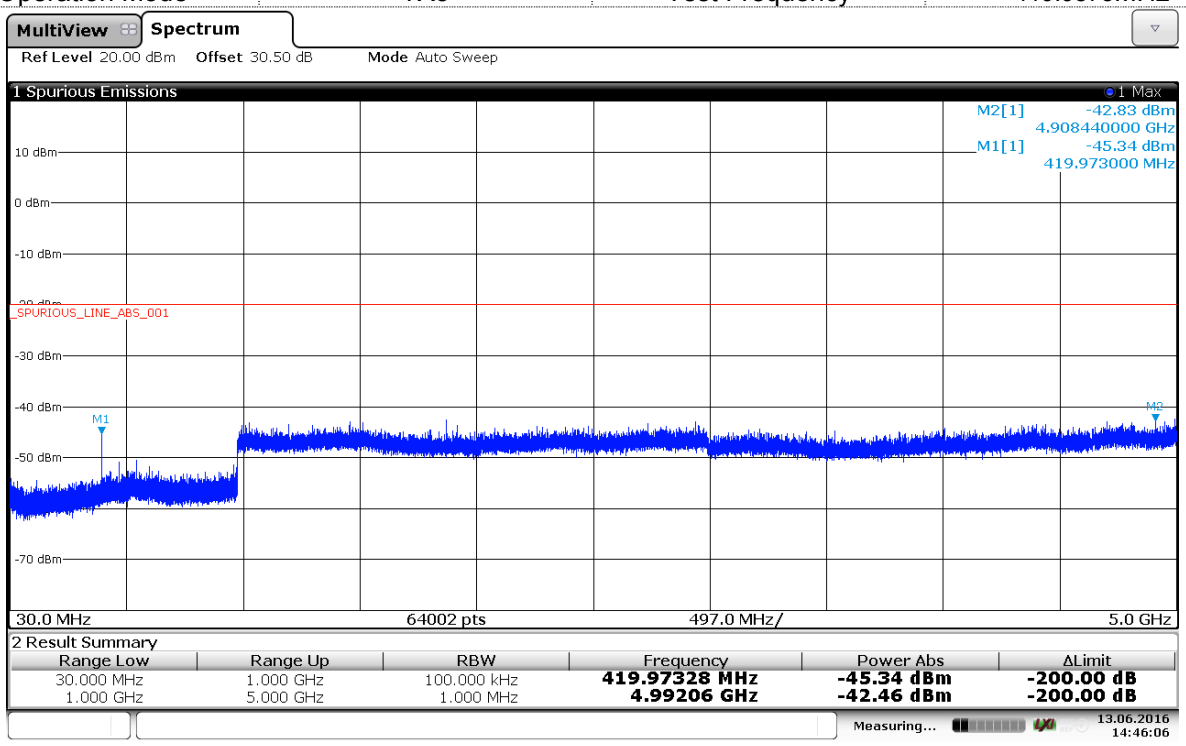

30MHz-5GHz

| Operation Mode | TX3 | Test Frequency | 413.05MHz |
|---|---|---|---|



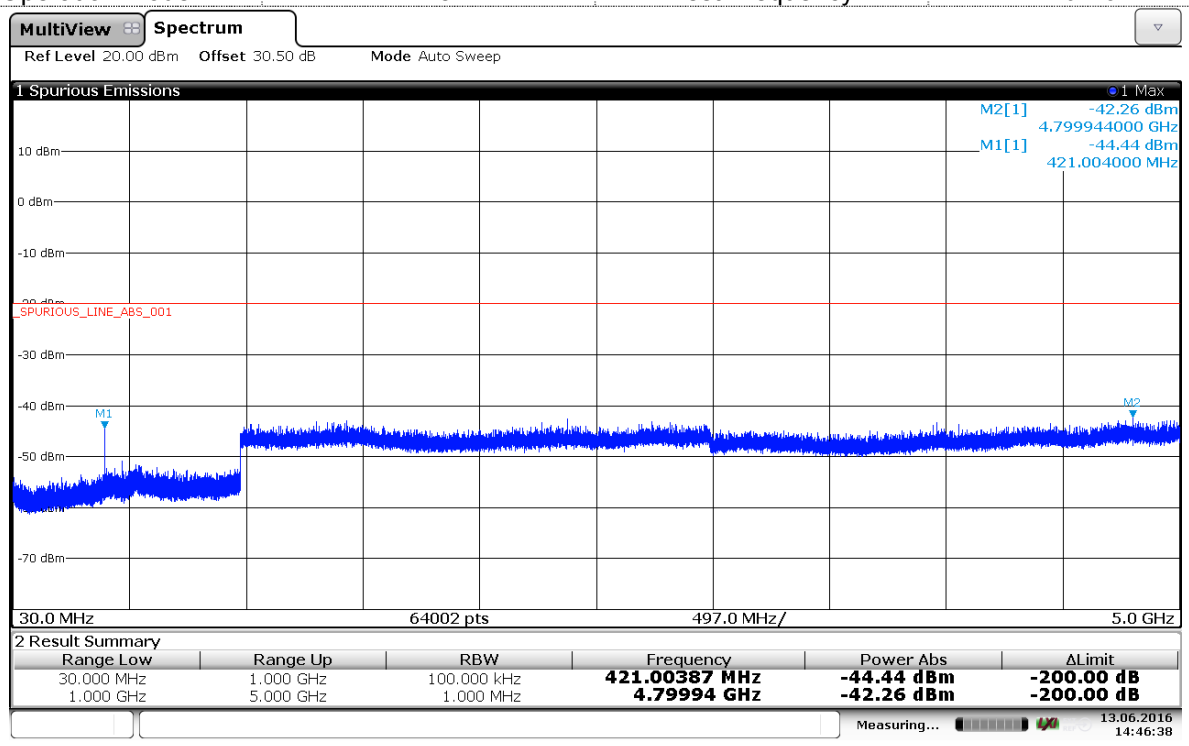

30MHz-5GHz

| Operation Mode | TX3 | Test Frequency | 419.9875MHz |
|---|---|---|---|



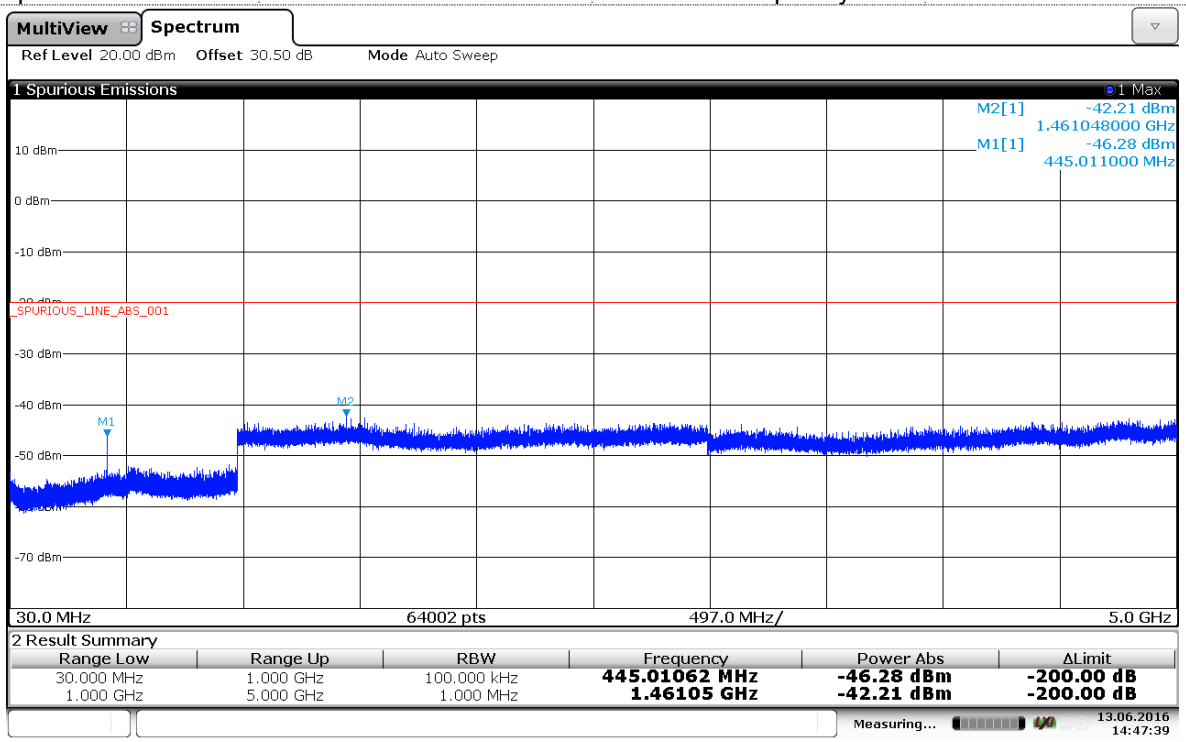

30MHz-5GHz

| Operation Mode | TX3 | Test Frequency | 421.0125MHz |
|---|---|---|---|



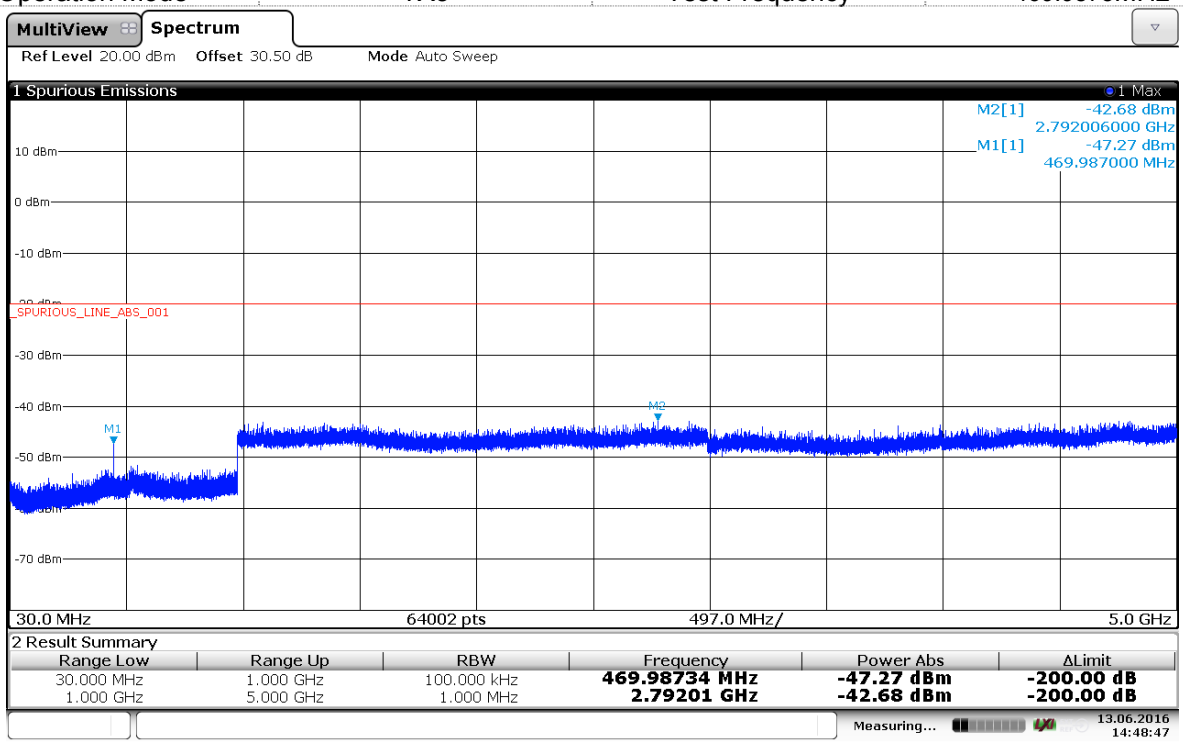

30MHz-5GHz

| Operation Mode | TX3 | Test Frequency | 445MHz |
|---|---|---|---|




30MHz-5GHz

| Operation Mode | TX3 | Test Frequency | 469.9875MHz |
|---|---|---|---|




30MHz-5GHz

## 4.8. Transmitter Radiated Spurious Emission

Radiated spurious emissions are emissions from the equipment when transmitting into a nonradiating load on a frequency or frequencies that are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communications desired.

**LIMIT**

**Modulation Type: 4FSK**

FCC Part 90.210，FCC Part 80.211，FCC Part 74.461，FCC Part 22.861，FCC Part 2.1053（12.5 kHz Bandwidth only):

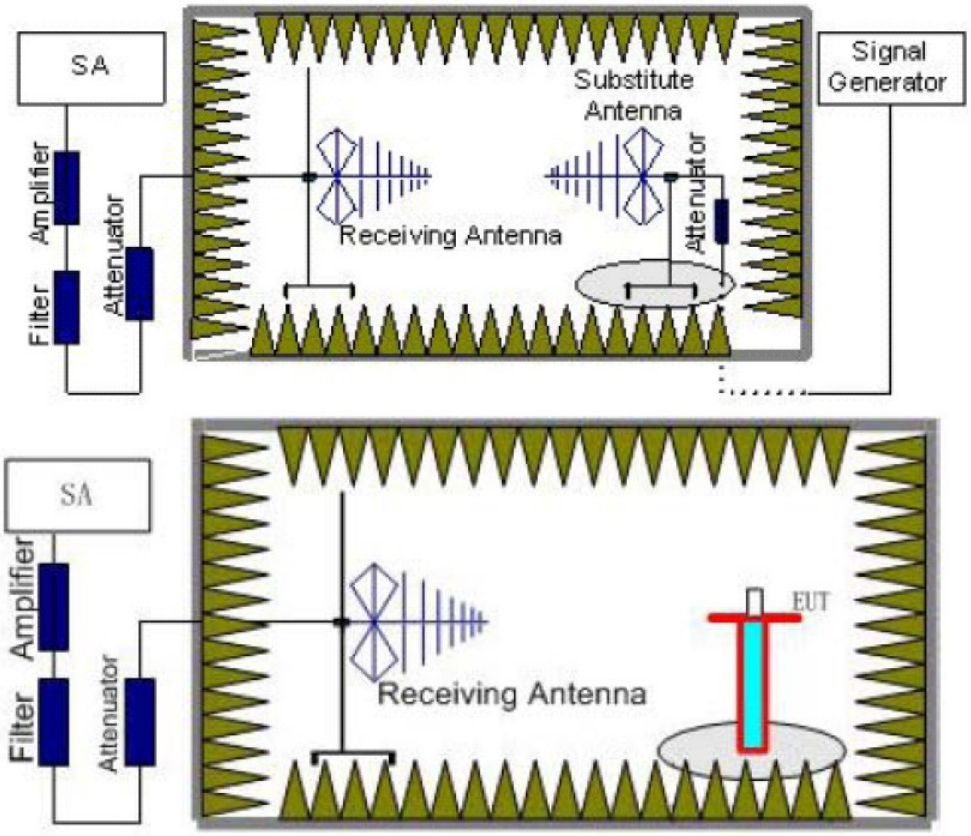
On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 12.5 kHz at least:
High: 50 + 10 log (Pwatts) = 50 + 10 log (40.93) =66.12dB

Note: In general, the worse case attenuation requirement shown above was applied.
Calculation: Limit (dBm) =EL-50-10log10 (TP)

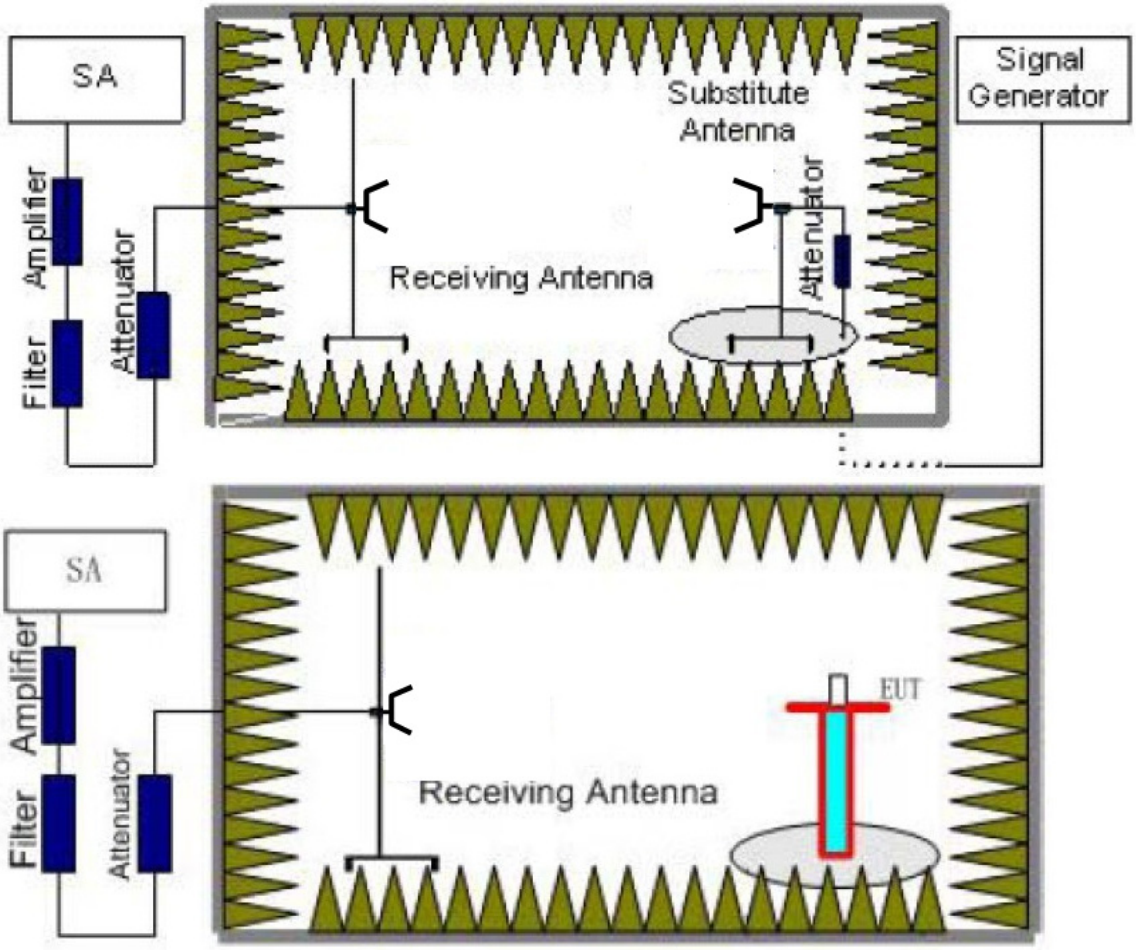
Notes: EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is 46.02 dBm.
Limit (dBm) =46.02-50-10log$_{10}$ (40.93) = -20dBm

**TEST CONFIGURATION**

**Below 1GHz:**




**Above 1GHz:**




**TEST PROCEDURE**

1. EUT was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1. 0 m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in six channels were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test.Set Test Receiver or Spectrum RBW=1MHz,VBW=3MHz for above 1GHz and RBW=100kHz,VBW=300kHz for 30MHz to 1GHz, And the maximum value of the receiver should be recorded as ($P_r$).
4. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power ($P_{Mea}$) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded ($P_r$). The power of signal source ($P_{Mea}$) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss ($P_{cl}$) ,the Substitution Antenna Gain ($G_a$) and the Amplifier Gain ($P_{Ag}$) should be recorded after test.
   The measurement results are obtained as described below:
   Power(EIRP)=$P_{Mea}$- $P_{Ag}$ - $P_{cl}$ - $G_a$
   We used SMF100A micowave signal generator which signal level can up to 33dBm,so we not used power Amplifier for substituation test; The measurement results are amend as described below:
   Power(EIRP)=$P_{Mea}$- $P_{cl}$ - $G_a$

6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.

**TEST MODE:**

Please reference to the section 2.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

Note:
1. In general, the worse case attenuation requirement shown above was applied.
2. The measurement frequency range from 30 MHz to 5 GHz.
3. Absolute Level=SG Level-Cable loss+Antenna Gain, Margin=Limit-Absulute Level
4. We tested TX1 to TX3 for AC 120V and DC 13.6V, recorded worst case TX1 and TX3 for AC 120V.

| Frequency (MHz) | Polar (H/V) | Receiver Reading (dBμV) | Substituted Method | | | Absolute Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| | | | S.G.Level (dBm) | Antenna Gain (dBd/dBi) | Cable Loss (dB) | | | |
| TX1:406.1125 MHz | | | | | | | | |
| 812.225 | H | 65.32 | -32.34 | 0 | 3.34 | -35.68 | -20 | 15.68 |
| 812.225 | V | 62.35 | -34.52 | 0 | 3.34 | -37.86 | -20 | 17.86 |
| 1218.3375 | H | 54.36 | -44.01 | 9.1 | 4.16 | -39.07 | -20 | 19.07 |
| 1218.3375 | V | 51.36 | -48.38 | 9.1 | 4.16 | -43.44 | -20 | 23.44 |
| 1624.45 | H | 50.36 | -51.26 | 11.8 | 5.51 | -44.97 | -20 | 24.97 |
| 1624.45 | V | 48.68 | -53.46 | 11.8 | 5.51 | -47.17 | -20 | 27.17 |
| TX1:413.05 MHz | | | | | | | | |
| 826.1 | H | 64.52 | -31.89 | 0 | 3.66 | -35.55 | -20 | 15.55 |
| 826.1 | V | 63.12 | -34.70 | 0 | 3.66 | -38.36 | -20 | 18.36 |
| 1239.15 | H | 55.24 | -45.38 | 8.65 | 4.21 | -40.94 | -20 | 20.94 |
| 1239.15 | V | 50.62 | -51.04 | 8.65 | 4.21 | -46.6 | -20 | 26.6 |
| 1652.2 | H | 51.03 | -50.44 | 11.12 | 5.68 | -45 | -20 | 25 |
| 1652.2 | V | 49.21 | -52.78 | 11.12 | 5.68 | -47.34 | -20 | 27.34 |
| TX1:419.9875 MHz | | | | | | | | |
| 839.975 | H | 65.32 | -31.53 | 0 | 3.44 | -34.97 | -20 | 14.97 |
| 839.975 | V | 62.32 | -36.20 | 0 | 3.44 | -39.64 | -20 | 19.64 |
| 1259.9625 | H | 54.32 | -47.04 | 8.46 | 5.43 | -44.01 | -20 | 24.01 |
| 1259.9625 | V | 49.86 | -51.00 | 8.46 | 5.43 | -47.97 | -20 | 27.97 |
| 1679.95 | H | 50.63 | -51.06 | 11.23 | 5.72 | -45.55 | -20 | 25.55 |
| 1679.95 | V | 48.96 | -53.73 | 11.23 | 5.72 | -48.22 | -20 | 28.22 |
| TX1:421.0125 MHz | | | | | | | | |
| 842.025 | H | 64.36 | -33.15 | 0 | 3.44 | -36.59 | -20 | 16.59 |
| 842.025 | V | 61.32 | -35.49 | 0 | 3.44 | -38.93 | -20 | 18.93 |
| 1263.0375 | H | 55.12 | -44.77 | 8.47 | 5.57 | -41.87 | -20 | 21.87 |
| 1263.0375 | V | 50.03 | -50.60 | 8.47 | 5.57 | -47.7 | -20 | 27.7 |
| 1684.05 | H | 49.86 | -51.79 | 11.32 | 5.74 | -46.21 | -20 | 26.21 |
| 1684.05 | V | 47.63 | -54.21 | 11.32 | 5.74 | -48.63 | -20 | 28.63 |
| TX1:445 MHz | | | | | | | | |
| 890 | H | 63.98 | -33.84 | 0 | 3.62 | -37.46 | -20 | 17.46 |
| 890 | V | 60.42 | -36.69 | 0 | 3.66 | -40.35 | -20 | 20.35 |
| 2350.46 | H | 54.89 | -45.14 | 8.56 | 5.67 | -42.25 | -20 | 22.25 |
| 2350.46 | V | 53.74 | -47.84 | 8.56 | 5.67 | -44.95 | -20 | 24.95 |
| 3186.09 | H | 50.23 | -50.46 | 11.36 | 5.78 | -44.88 | -20 | 24.88 |
| 3186.09 | V | 48.21 | -54.00 | 11.36 | 5.78 | -48.42 | -20 | 28.42 |
| TX1:469.9875MHz | | | | | | | | |
| 939.975 | H | 62.35 | -35.67 | 0 | 3.02 | -38.69 | -20 | 18.69 |
| 939.975 | V | 59.74 | -38.88 | 0 | 3.02 | -41.9 | -20 | 21.9 |
| 2350.46 | H | 53.64 | -46.28 | 8.62 | 6.32 | -43.98 | -20 | 23.98 |
| 2350.46 | V | 52.74 | -47.62 | 8.62 | 6.32 | -45.32 | -20 | 25.32 |
| 3290.32 | H | 51.25 | -49.70 | 11.52 | 7.13 | -45.31 | -20 | 25.31 |
| 3290.32 | V | 49.03 | -52.84 | 11.52 | 7.13 | -48.45 | -20 | 28.45 |

| Frequency (MHz) | Polar (H/V) | Receiver Reading (dBμV) | Substituted Method | | | Absolute Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| | | | S.G.Level (dBm) | Antenna Gain (dBd/dBi) | Cable Loss (dB) | | | |
| TX3:406.1125 MHz | | | | | | | | |
| 812.225 | H | 65.42 | -32.24 | 0 | 3.34 | -35.58 | -20 | 15.58 |
| 812.225 | V | 62.96 | -33.91 | 0 | 3.34 | -37.25 | -20 | 17.25 |
| 1218.3375 | H | 53.62 | -44.75 | 9.1 | 4.16 | -39.81 | -20 | 19.81 |
| 1218.3375 | V | 50.41 | -49.33 | 9.1 | 4.16 | -44.39 | -20 | 24.39 |
| 1624.45 | H | 51.26 | -50.36 | 11.8 | 5.51 | -44.07 | -20 | 24.07 |
| 1624.45 | V | 47.62 | -54.52 | 11.8 | 5.51 | -48.23 | -20 | 28.23 |
| TX3:413.05 MHz | | | | | | | | |
| 826.1 | H | 64.63 | -31.78 | 0 | 3.66 | -35.44 | -20 | 15.44 |
| 826.1 | V | 63.21 | -34.61 | 0 | 3.66 | -38.27 | -20 | 18.27 |
| 1239.15 | H | 52.57 | -48.05 | 8.65 | 4.21 | -43.61 | -20 | 23.61 |
| 1239.15 | V | 51.06 | -50.60 | 8.65 | 4.21 | -46.16 | -20 | 26.16 |
| 1652.2 | H | 50.42 | -51.05 | 11.12 | 5.68 | -45.61 | -20 | 25.61 |
| 1652.2 | V | 46.98 | -55.01 | 11.12 | 5.68 | -49.57 | -20 | 29.57 |
| TX3:419.9875 MHz | | | | | | | | |
| 839.975 | H | 64.02 | -32.83 | 0 | 3.44 | -36.27 | -20 | 16.27 |
| 839.975 | V | 62.47 | -36.05 | 0 | 3.44 | -39.49 | -20 | 19.49 |
| 1259.9625 | H | 51.58 | -49.78 | 8.46 | 5.43 | -46.75 | -20 | 26.75 |
| 1259.9625 | V | 50.69 | -50.17 | 8.46 | 5.43 | -47.14 | -20 | 27.14 |
| 1679.95 | H | 51.25 | -50.44 | 11.23 | 5.72 | -44.93 | -20 | 24.93 |
| 1679.95 | V | 47.68 | -55.01 | 11.23 | 5.72 | -49.5 | -20 | 29.5 |
| TX3:421.0125 MHz | | | | | | | | |
| 842.025 | H | 64.39 | -33.12 | 0 | 3.44 | -36.56 | -20 | 16.56 |
| 842.025 | V | 65.25 | -31.56 | 0 | 3.44 | -35 | -20 | 15 |
| 1263.0375 | H | 52.69 | -47.20 | 8.47 | 5.57 | -44.3 | -20 | 24.3 |
| 1263.0375 | V | 51.42 | -49.21 | 8.47 | 5.57 | -46.31 | -20 | 26.31 |
| 1684.05 | H | 50.69 | -50.96 | 11.32 | 5.74 | -45.38 | -20 | 25.38 |
| 1684.05 | V | 48.05 | -53.79 | 11.32 | 5.74 | -48.21 | -20 | 28.21 |
| TX3:445 MHz | | | | | | | | |
| 890 | H | 64.47 | -33.35 | 0 | 3.62 | -36.97 | -20 | 16.97 |
| 890 | V | 65.25 | -31.86 | 0 | 3.66 | -35.52 | -20 | 15.52 |
| 2350.46 | H | 52.69 | -47.34 | 8.56 | 5.67 | -44.45 | -20 | 24.45 |
| 2350.46 | V | 51.42 | -50.16 | 8.56 | 5.67 | -47.27 | -20 | 27.27 |
| 3186.09 | H | 50.69 | -50.00 | 11.36 | 5.78 | -44.42 | -20 | 24.42 |
| 3186.09 | V | 48.05 | -54.16 | 11.36 | 5.78 | -48.58 | -20 | 28.58 |
| TX3:469.9875MHz | | | | | | | | |
| 939.975 | H | 63.62 | -34.40 | 0 | 3.02 | -37.42 | -20 | 17.42 |
| 939.975 | V | 62.47 | -36.15 | 0 | 3.02 | -39.17 | -20 | 19.17 |
| 2350.46 | H | 51.62 | -48.30 | 8.62 | 6.32 | -46 | -20 | 26 |
| 2350.46 | V | 50.25 | -50.11 | 8.62 | 6.32 | -47.81 | -20 | 27.81 |
| 3290.32 | H | 49.68 | -51.27 | 11.52 | 7.13 | -46.88 | -20 | 26.88 |
| 3290.32 | V | 47.86 | -54.01 | 11.52 | 7.13 | -49.62 | -20 | 29.62 |

## 4.9. Conducted Emissions Test

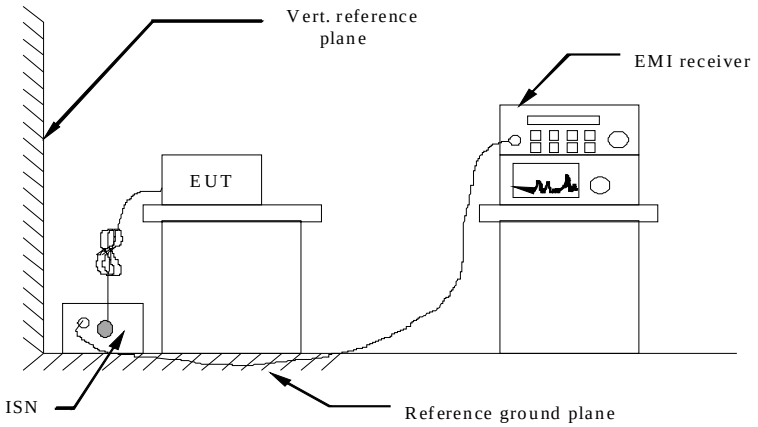
The frequency spectrum from 0.15 MHz to 30 MHz was investigated. The LISN used was 50 ohm / 50 u Henry as specified by section 5.1 of ANSI C63.4 - 2009. Cables and peripherals were moved to find the maximum emission levels for each frequency.

**Limit**

**FCC part 15.107(a)**

| Frequency of Emission (MHz) | Conducted Limit (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56 * | 56 to 46 * |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

**TEST CONFIGURATION**




**TEST PROCEDURE**

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.4-2009.
2 Support equipment, if needed, was placed as per ANSI C63.4-2009.
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4-2009.
4 If a EUT received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5 All support equipments received AC power from a second LISN, if any
6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7 Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8 During the above scans, the emissions were maximized by cable manipulation.

**TEST MODE:**

Please reference to the section 2.4

**TEST RESULTS**

☐ **Passed** ☒ **Not Applicable**

## 4.10. Radiated Spurious Emission

**LIMIT**

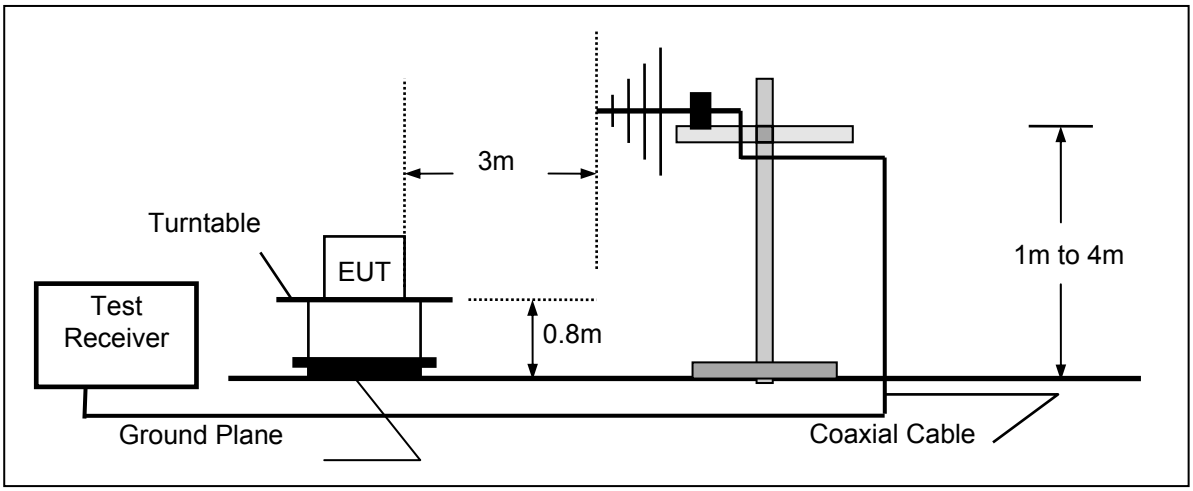
For unintentional device, according to § 15.109(a) except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

| Frequency (MHz) | Distance (Meters) | Radiated (dBμV/m) | Radiated (μV/m) |
|---|---|---|---|
| 30-88 3 | | 40.0 | 100 |
| 88-216 3 | | 43.5 | 150 |
| 216-960 3 | | 46.0 | 200 |
| Above 960 | 3 | 54.0 | 500 |

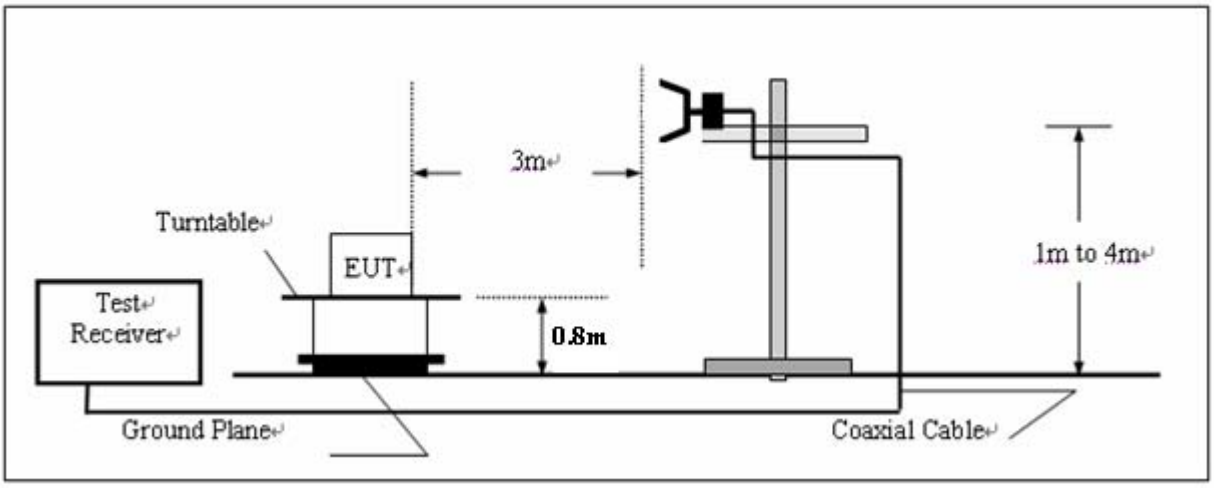
For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

**TEST CONFIGURATION**

(A) Radiated Emission Test Set-Up, Frequency below 1000MHz




(B) Radiated Emission Test Set-Up, Frequency above 1000MHz



**TEST PROCEDURE**

1 The EUT was placed on a turn table which is 0.8m above ground plane.
2 Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3 And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4 Repeat above procedures until all frequency measurements have been completed.

**TEST MODE:**

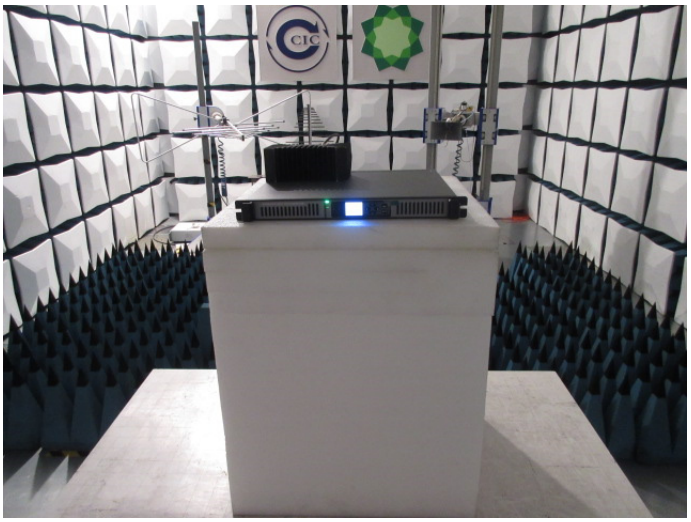
Please reference to the section 2.4

**TEST RESULTS**

☐ **Passed** ☒ **Not Applicable**

Note:
The EUT shall be scanned from 30 MHz to the 5th harmonic of the highest oscillator frequency in the digital devices or 1 GHz whichever is higher.

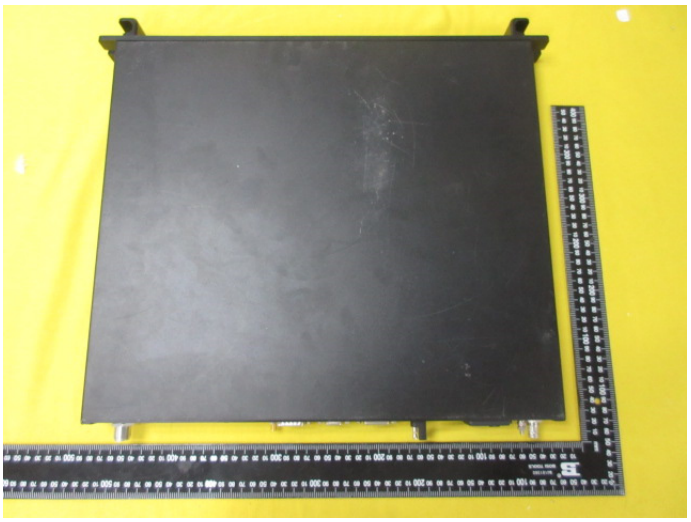
# 5. Test Setup Photos of the EUT

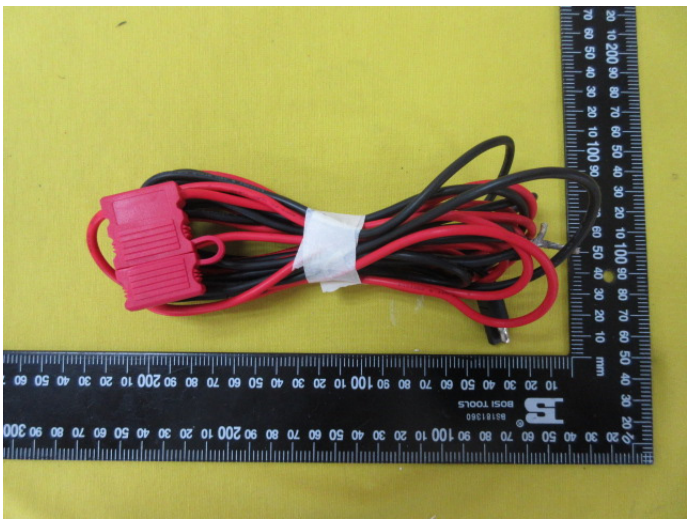


# 6. External and Internal Photos of the EUT

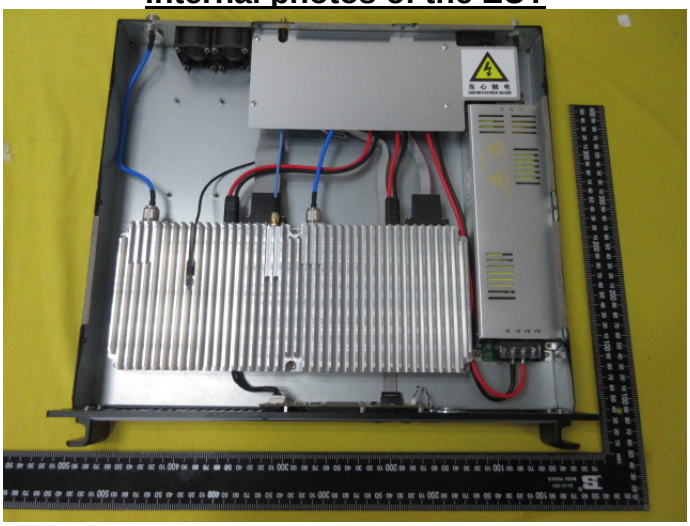
## External photos of the EUT

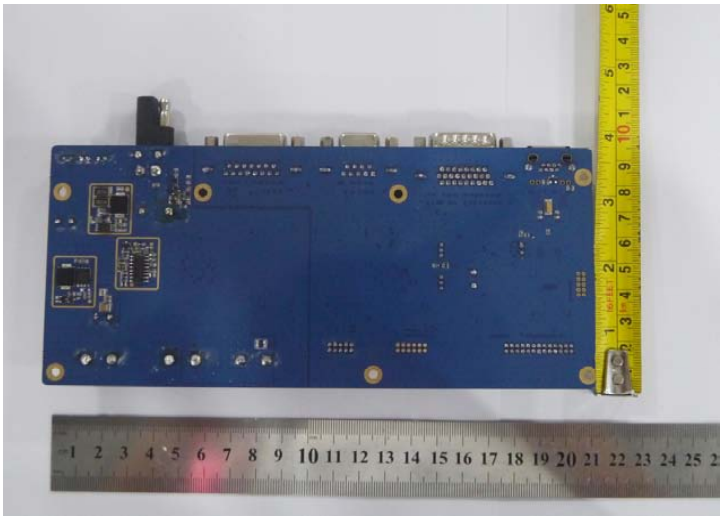


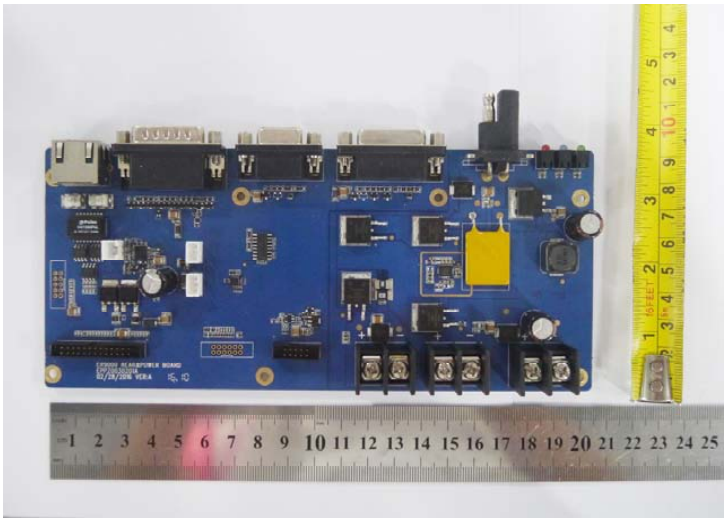


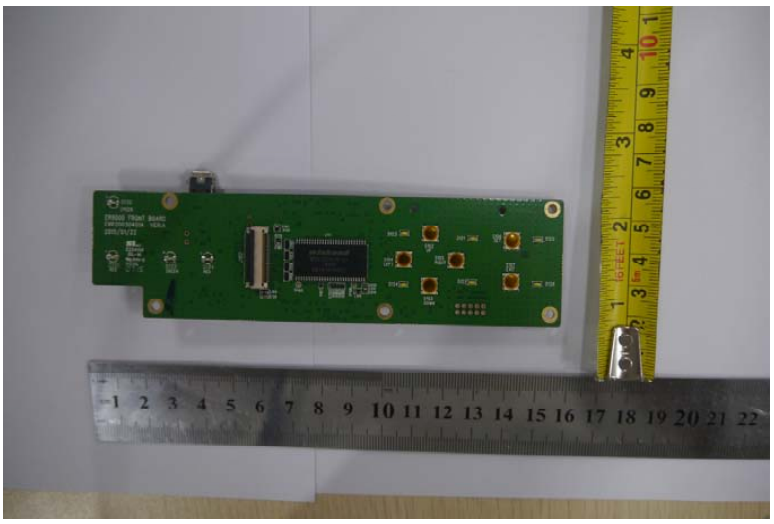


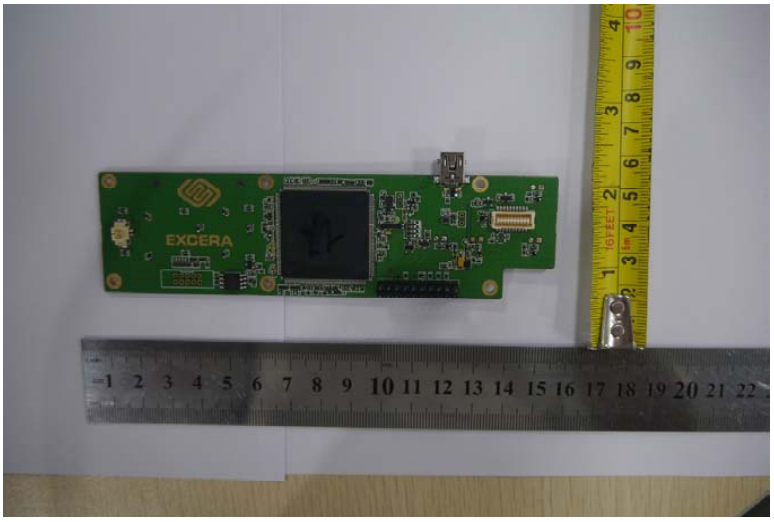
## Internal photos of the EUT

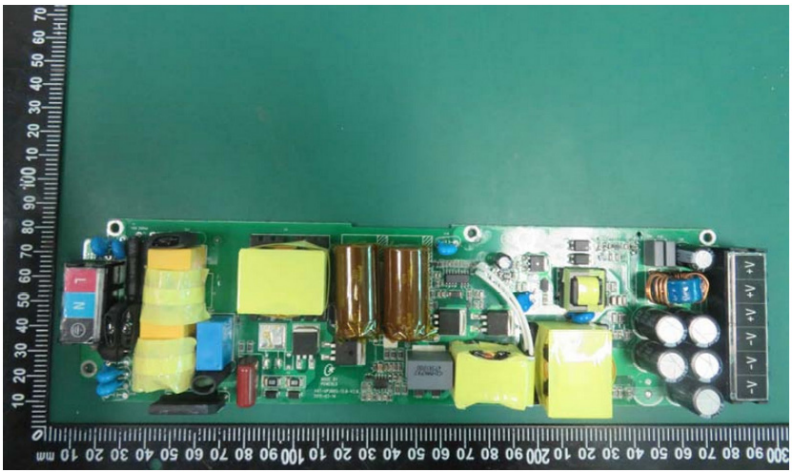


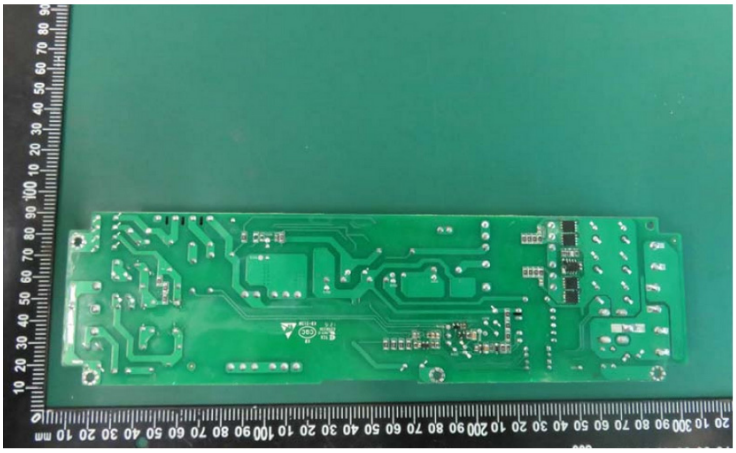


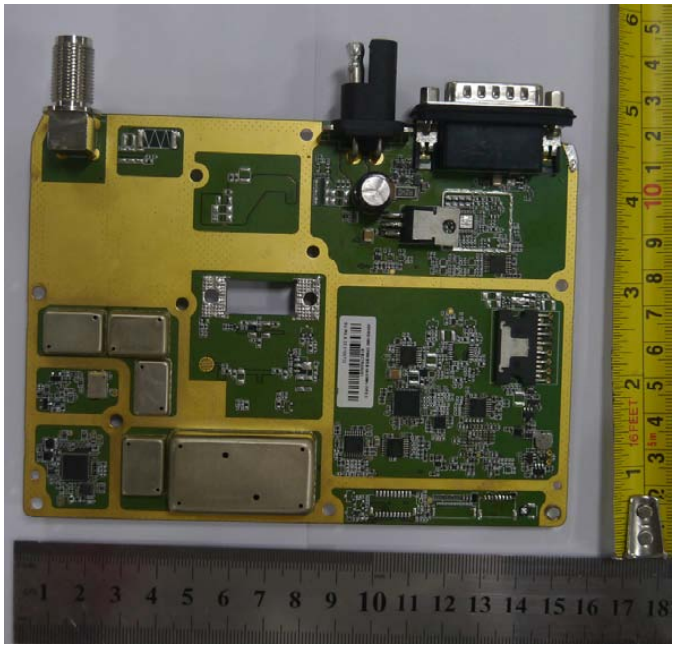


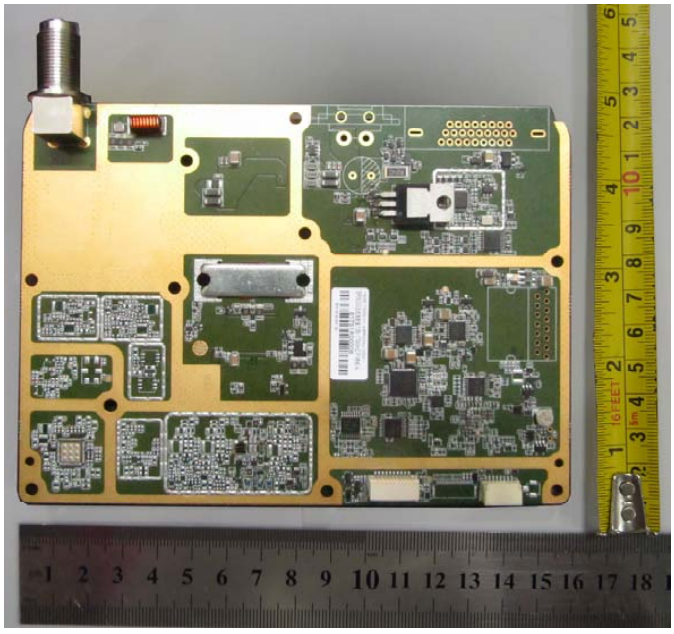


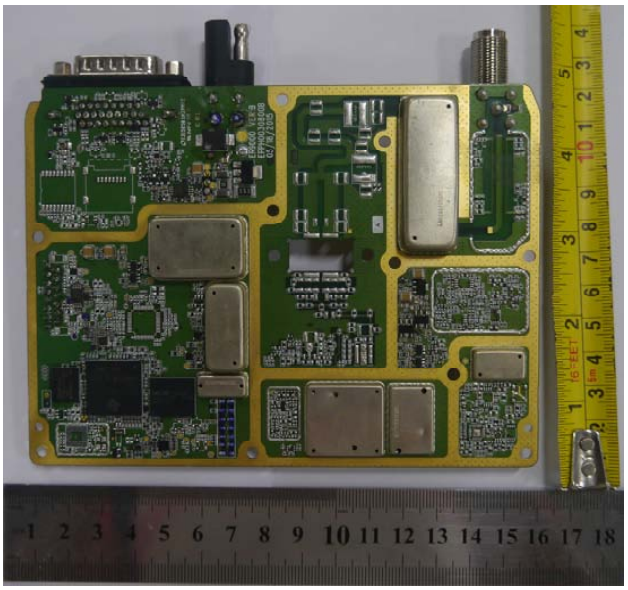

EXCERA

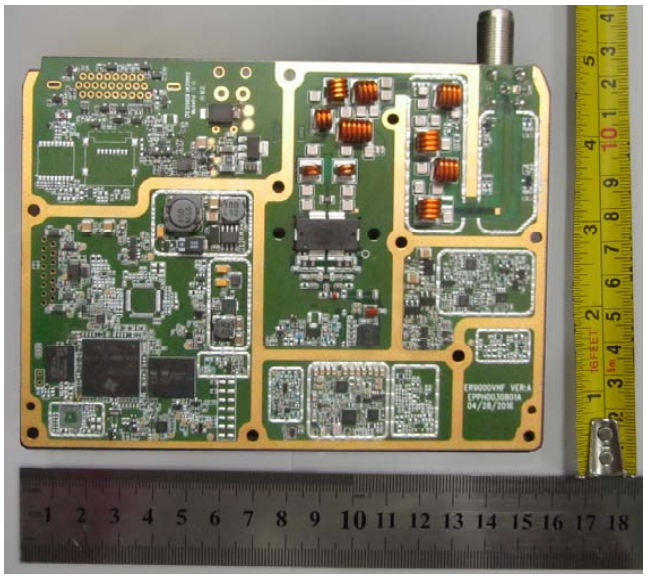


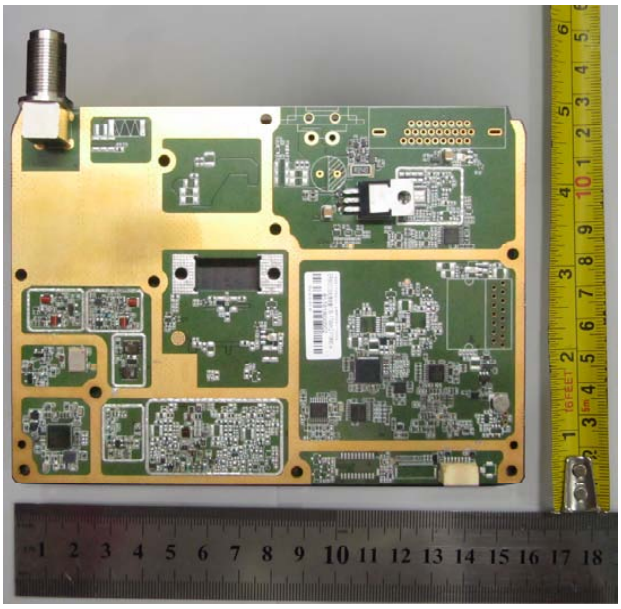


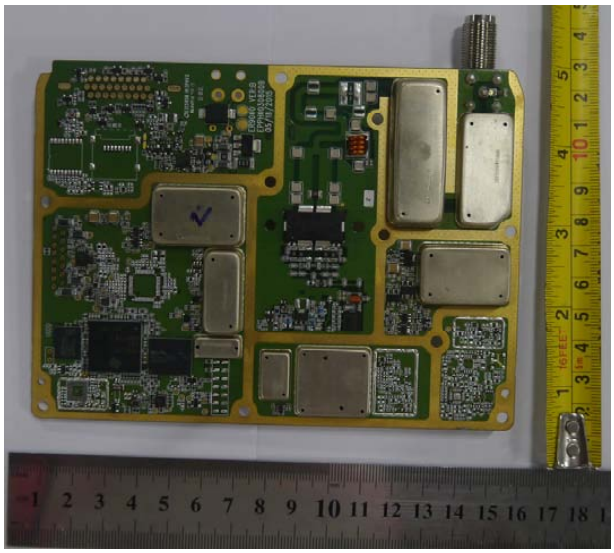


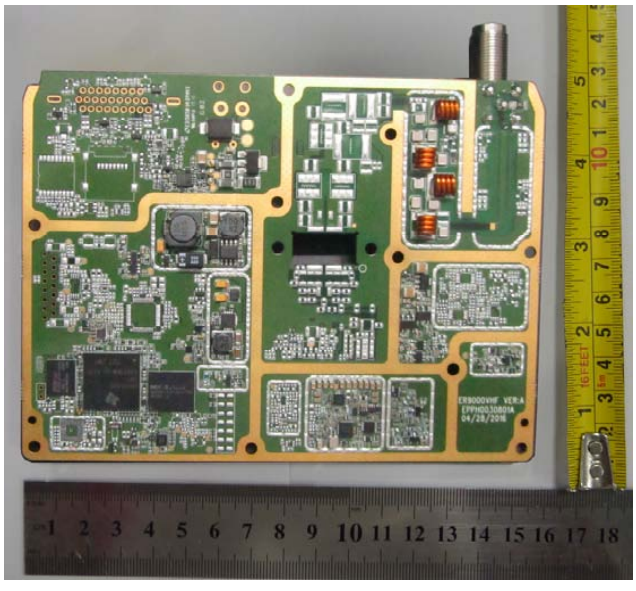












**.....End of Report.....**